National Education Policy Information System

For

EPRD

Education Planning and Policy Research Division
Ministry of Education, Malaysia

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ABSTRACT

National Education Policy Information System (NEPIS) is a web based system developed with the objective of implementing the information system on the Internet as a solution to publish education policy to the users in an effective manner. Overview of the proposed system is discussed in the beginning of this document followed by a review on current systems and development technologies. Then, the reader is introduced to system requirements and system design. Finally, the system design of NEPIS is presented to the reader. It consists of two modules. The administrator module enables administrator to maintain the database that stores related documents and access control to the database while the user module provides search, browse and view features to facilitate retrieving the intended documents and feedback capabilities for returning users' comment about the system. A mixture of waterfall, prototyping and incremental methodology is used to develop these two modules. It is hope that by combing three developments methodology can ease the development process and get the best result out of these methodologies. NEPIS is developed using Microsoft Visual InterDev as the development environment for Active Server Page on Microsoft Windows NT 4.0 platform. Microsoft SQL Server 7.0 is used to create database and store information on education policy. The proposed system is expected to provide some basic features for retrieving related documents and to provide room for future improvement.

ACKNOWLEDGEMENT

First of all, I would like to express my utmost gratitude to my supervisor, Puan Abrizah (Lecturer of Faculty of Computer Science and Information Technology) in providing the guidance, support and advice throughout the whole project. Being an understanding and open-minded lecturer, she has provided a platform for student to explore and work independently without any fear of wrongdoing.

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CHAPTER 1: Introduction

1.1 Project Background

Policies to be implemented in an organization are planned and determined by administrators or policy makers at the top level management. Policy serves as a 'base' or a 'guideline' for a well defined action plan to meet the objectives of an organization. Government administrators and officers carry out their duties based on the policies determined by the top managements, especially those providing services to the public.

Therefore, a government policy can be assumed as an official statement that is received and issued by the government. The public can understand the purposes or objectives that government bodies are trying to achieve. By understanding the objectives, the public can have a clear picture how an action plan is implemented at the national or state level.

There are a few types of polices in Malaysia, among them are development policy, economic policy, and social policy. This document will only cover one of the many social policies in Malaysia, that is the **National Education Policy** as the background of research for the purpose of developing an information system to retrieve information related to the policy.

National Education Policy is based on the National Philosophy of Education to emphasis on creating individuals who are intellectually, spiritually, emotionally and physically balanced and harmonious, based on a firm belief in and devotion to God. Such an effort is designed to Malaysian citizens who are knowledgeable and competent, who possess high moral standards, and who are responsible and capable of achieving a high level of personal well being as well as being able to contribute to the family, society and the nation at large.

The National Education Policy 1961 was amended based on the Razak Report 1956 and the Rahman Talib Report 1960. The main objective of this policy is to create understanding and unity among the citizens of Malaysia.

After several personal observations, the writer found out that researchers who wish to gather information related to National Education Policy have to rely on several sources. Thus, the process of information gathering is inefficient, ineffective and time consuming. If the time uses for gathering documents for National Education Policy can be reduced then more time can be used in analyzing the documents.

The increasing number of users get connected to the Internet everyday has made Internet a significant place for providing the users with necessary features to locate documents on National Education Policy. The writer will like to develop a web based system that enable users to locate information related to National Education Policy using the Internet as a distributing medium. This proposed system can be integrated with existing system in the Policy Unit, of the Education Planning and Policy Research Division (EPRD) of the Ministry of Education, Malaysia.

1.2 Project Overview

It is hard to imagine any industry or business that has not been affected by computer based information system and computer applications nowadays. Many businesses consider management of their information resource as important as management of their other key resources like property, facilities, employees and capital.

To fulfill the information need of the users, a new project idea has been appears. It is called the National Education Policy Information System (NEPIS). NEPIS is a system that able to take advantage of new technology to support the needs to access information more efficiently and effectively. Its purpose is to provide the managerial and technological means to enable people to work smarter and easier.

NEPIS is the architecture for management, organization, composition and retrieval of the data, information and knowledge embodied in paper and electronic documents. This architecture, (web-enabled) is a step towards supporting the common and universal needs of any office and business environment. Its main purpose is to provide information access to the users at any time, anywhere considering the availability of information is high.

NEPIS is a new idea that not only will bring along a lot of benefit to the users but also will make people aware that the importance of electronic library in this fast changing information age.

1.3 Project Motivation

NEPIS is the suitable solution for the problems that appear in getting information about National Education Policy and documents related to it such as Education Acts, Cabinet paper, minutes of meeting and so on. One has to search from one document to another document from different sources in order to gather all the required information related to this policy manually which is time and energy consuming. Through NEPIS, some of the information gathering processes can be automated to simplify and shorten the time needed.

1.4 Project Purpose

NEPIS is designed to support knowledge workers like individuals for whom the manipulation of information and knowledge is their daily work. This is possible because all knowledge workers like researchers, software developers, administrative assistants, clerks and stock keepers require the same core functionality to maintain timely access to information and knowledge in a form suited to the intended use.

The main purpose of this project is to enable the users to view the National Education Policy and its related information in an organized, sorted and categorized manner. It is to ensure that data, information and knowledge can distribute to others using the Internet.

By using the Internet an interactive and effective way can be deploy to retrieve the necessary documents from the database. For example, the users can search for a policy related document using the search capability of the system. Thus, the efficiency of retrieving documents can be increased.

1.5 Project Objective

The proposed system will have a few objectives, they are:

- To create a paperless environment
- To develop an easy to use and user friendly system
- To enhance the manual methods used to retrieve information related to the policy
- To help the researchers to gather related information on Malaysia National Education Policy
- To develop a one-stop portal on National Education Policy
- To ease the administration of documents related to the policy
- To increase quality and accuracy in data keeping

1.6 Statement of Problem

An informal survey done by the author has found out that many problems are faced when people try to gather information related to National Education Policy. Following are a list of the problem that need to be solved:

- The documents related to the National Education Policy is not just located in a single library but scattered around a few libraries. One has to travel from one library to another to search for the information he or she required

- Most of the documents related to the National Education Policy can only be use as a reference at a particular library for The National Library, so one has to keep on coming to that particular library in order to gather all the required information. This is very inconvenient. If the books can be borrow out from the libraries then it is easier for people to analyze the information at home than going to the library which is a distance away

- A large amount time is wasted in the process of information gathering because one might not find what he or she wants in a single library, so he or she has travel from one library to another to look for the necessary information

1.7 Project Scope

The proposed system will consist of four modules:

- A browse module
  This module will enable the users to browse for certain information based on pre-categorized criteria such as the date, act, sub title and so on.

- A search module
  This module will enabled the users to search for a certain document by using a search engine developed in this module.

- A administration module
  This module will enable the system administrator to add, modify and delete certain data in the database.

- A feedback module
  This module is intended to get the feedback from the user regarding the performance of the proposed system.

- A attachment module
  This module will enable the users of the system to submit documents for the administrator to review and put it the documents archive.

1.8 Importance of Project

The benefits achievable with the information system are significant. The following are some of the benefits those we can gain from it:

1.8.1 More Organized Information

The proposed system can help the staff at the Policy Unit, of the EPRD of the Ministry of Education, Malaysia to manage the documents related to National Education Policy in an organized manner.

1.8.2 Quick Reference

Researchers in the Policy Unit, of the EPRD of the Ministry of Education, Malaysia can have a quick reference on the National Education Policy when they would like to review the previous National Education Policy implemented.

1.8.3 Easy Access to Information

Information can be easily accessed due to the fact the system is implemented in a web based environment. The users can get the information they required by connecting to the Internet.

1.8.4 Cost Saving

The users can save cost (cost directly or indirectly getting the information manually) in getting the necessary information by using the proposed system.

1.8.5 Save Time

This can be a one stop information center regarding to the National Education Policy and information related to it. Thus, saving a lot of in the process of information gathering.

1.8.6 Efficiency

The users will get the required information in a fast and efficient manner due to the fact that the data is already organized properly in a database.

1.9 Project Development Model

Process model is very important during the development of software. It can form a common understanding, of the activities, resources and constraints involved in software development. When a process model is created, it can help us to find the inconsistencies, redundancies and omissions in the process. There are many types of process models like Waterfall model, V model, Prototyping model, Transformational model, spiral model and others.

Before a process model is chosen, it should reflect the goals of the development. Thus, the process model for this project is a mixture of the Waterfall, Prototyping and Incremental development models (Figure 1.1). It is actually using Waterfall model concept but the prototyping and incremental concept is added during the modules development.

The Waterfall model presents a very high-level view of what is happening during development and it suggests to us the sequence of events, which will encounter. It helps us to plan what we need to do (Pfleeger, Lawrence, 1998). The overall stage of the process model will be discussed one by one as below:

1.9.1 Concept Definition

The concept, purpose and functionality of the **National Education Policy Information System** are identified and defined.

1.9.2 Requirement Specification

This stage will involve the collection of information from a feature of the system or a description of something that the system is capable to do in order to fulfill the system purpose. In this case, I get most of the requirements from some of the officers at the Documentation Center, Education Planning and Policy Research Division, Ministry of Education, Malaysia and some ideas from my supervisor. After

collecting the information, it has to be rewritten so that it can be transformed into a good system design.

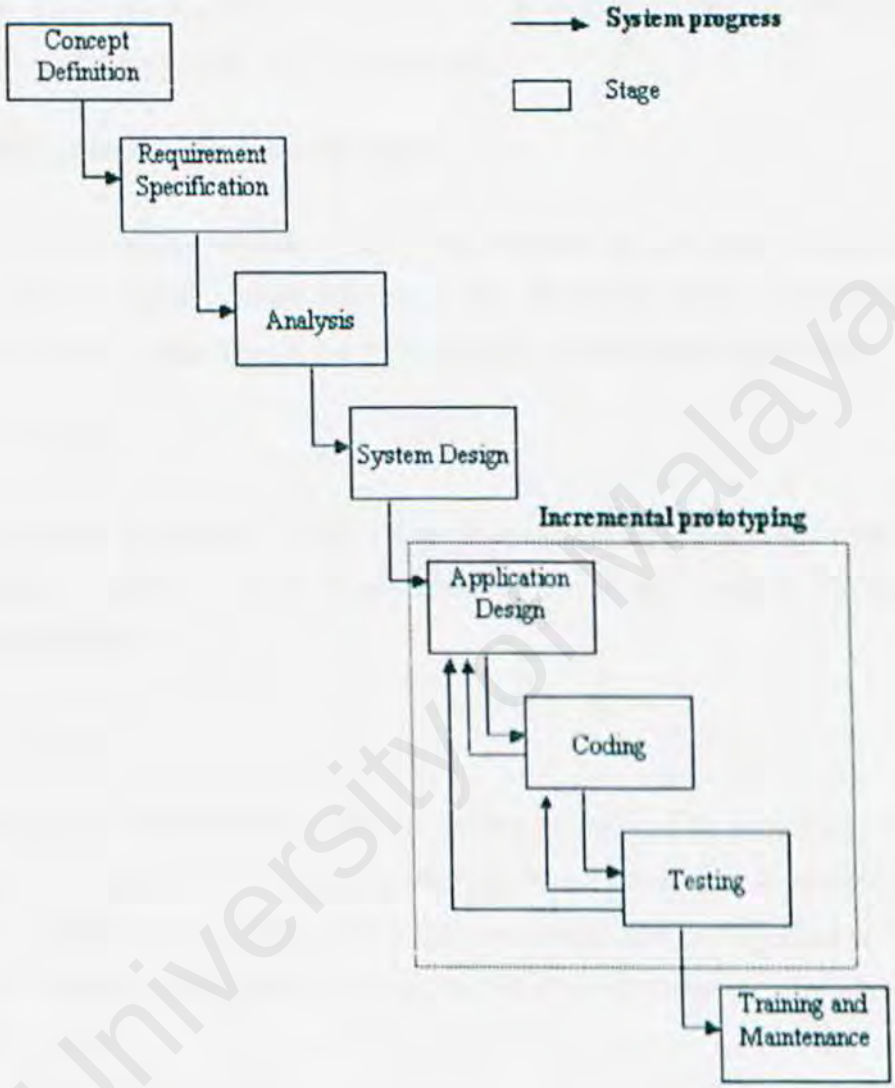

Figure 1.1 National Education Policy Information System Development Model

1.9.3 System Analysis

During this stage, the writer has to study the existing system (manual retrieval process) that is available and do the planning for the new system. After finish this stage it comes to system design.

1.9.4 System Design

Under this stage, an alternative solution is set. All the application or modules design at the next stage will strictly follow this solution.

1.9.5 Application or Modules Design

For this project, the incremental prototyping method will be used during this stage and the following stage. Under this stage, the prototype will be created based on each module that is specified in the project. Then, it is followed by the coding stage.

1.9.6 Coding

Under this stage, a variety of tools and techniques will be used to write the program base on the prototype. If there is any problem, it will refer back to the application and modules design.

1.9.7 Testing

After coding the program components, testing is needed to examine the code to spot faults and eliminate it. It is necessary to ensure that the application program written in isolation work properly when they are integrated into the total system. Any problem faced on this stage will refer to the coding stage or the application or modules design.

1.9.8 Training and Maintenance

This will be the last stage. The purpose of this stage is to help users to understand and feel comfortable about the new National Education Policy Information System. This stage will give guidance to the users about the usage of the new system and how they can use it effectively.

1.10 Project Timeline

The timeline of the project is shown in Figure 1.2. The project will be start at 5th June 2000 until 10th February 2001.

No	Task Name	Start Date	End Date	2000							2001	
				Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
1.	Concept of Definition	05/06/00	09/06/00									
2.	Requirement Specification & Analysis	10/06/00	01/08/00									
3.	System Design	02/08/00	21/08/00									
4.	Incremental Prototyping	22/08/00	22/12/01									
5.	Integration & Testing	23/12/01	15/01/01									
6.	Documentation	16/01/01	01/02/01									
7.	Training & Maintenance	02/02/01	10/02/01									

Figure 1.2 Project Schedule

1.11 Summary

This system proposal is part of the thesis document. Below is the outline of this system proposal:

Chapter 1: This chapter will introduce the proposed system to the readers. The proposed system overview, objectives, relevance, importance and scope will presented in a higher-level perspective to give reader a glance through about the project.

Chapter 2: Provide a review of existing system and published literature on education policy. This chapter will also focus on reviewing the development technologies that will be used to develop the proposed system.

Chapter 3: This chapter contains detail information on the system requirements and methodology used to develop the proposed system. It will provide reader with information about what modules consist in the proposed system and the specification of the modules.

Chapter 4: This chapter explains the design stage of NEPIS whereby various designs are developed that includes graphical user design and database design.

Chapter 5: This chapter discusses about NEPIS's system implementation. In this chapter, the reader will be able to understand how NEPIS is implemented using Windows 2000 Server environment.

Chapter 6: After reading this chapter, the reader will know how the system is tested using different type of testing approaches such as unit testing, module testing, integration and so on.

Chapter 7: In this chapter, the reader will be briefed on system evaluation. NEPIS strengths and limitations will be explained in details. This chapter will also provide the reader details about problems faced by the writer and knowledge gained by solving these problems. At the end of the chapter an overall conclusion will be make regarding the project.

CHAPTER 2: Literature Review

2.1 Introduction

In the process of developing NEPIS, a lot of research has been done to understand various new concepts. The Policy Unit of EPRD of the Ministry of Education of Malaysia has been chosen as the test bed for the project. It is because many process in searching for materials about the policy are not automated and the researchers face a lot of problem in information gathering.

After getting feedbacks, suggestions and information from some policy researchers, it is decided to develop a system that could overcome the shortcomings and maximize the information retrieval process. NEPIS is one type of the Computer-Based Information System (CBIS) because it relies on computer hardware and software for transferring, processing and storing data.

A formal system is a system resting on typical accepted and fixed definitions of data and procedures, operating with predefined rules. Formal information system can be either computer based or manual. Manual system use paper and pencil technology. Computer-based information system, in contrast, rely computer hardware and software technology to process and to disseminate information.

For NEPIS system, many books and few existing system were used as a guide and to gain information as well as a better idea how to develop the system. Furthermore, interviews with a few EPRD officers were done to gain information on current system used to retrieve National Education Policy.

Besides that, the Internet was surfed and information was gathered from various sites on education policy and development technologies to be used to develop the proposed system. The search engines that were used to gather all this information include Yahoo search (http://www.yahoo.com), Alta Vista search (http://www.altavista.com), Lycos search (http://www.lycos.com) and Excite search (http://www.excite.com).

As a conclusion most of the findings for the proposed system came from various sites on the World Wide Web (WWW) and books. As a result of this research, the found sources can be divided into two that includes the printed resources and the electronic resources.

2.2 The Need for NEPIS

Paper is inefficient because it is hard to update and the information contained on one piece of paper is hardly related to information on the other pieces of paper. It is also quite difficult to access and retain all the information that crosses our lives daily in everywhere. Besides that, the clerk has to manage with large volumes of documents, which often duplicates every day. This wastes a lot of time that can be used to do other important task and it causes problem in the timely management.

As environmental concerns become more critical and fewer trees are harvested, price of the cellulose to make paper is increasing dramatically. This causes the price of paper rises. Due to the development in sciences, the communication industries had offered us nano-technology, optical storage, virtual reality, interactive real time environments of work and play. Therefore, information system and computer application will be essential for most of the organization to compete or gain competitive advantage.

Data are received, stored and retrieved by certain type of media. The data are impersonal; they are equally available to any users of the system. Information, in contrast, is a set of data that have been matched to a particular information need. That is, the concept of information has both personal and time dependent components that are not present in concept of data.

People need information to solve problems, whether as simple as deciding on an evening's entertainment or as weighty as resolving a world crisis. Some of this information is readily available; other information requires extensive searching and

the assembly of ideas from multiple sources: their own background, friends and colleagues, experts, libraries, and public and private information sources.

In this era of information age required the establishment of a technology infrastructure that provides connectivity and the necessary tools to get the job done.

The writer to support the needs for developing the proposed system conducted a research to search for documents that support for the proposed system. From the research, the writer manage to found several documents from the ERIC database (http://ericir.syr.edu).

An Educational Information System (EIS) was proposed to be a computer-based data processing system to help schools solve current educational problems more efficiently. The system would allow for more effective administrative operations in student scheduling, financial accounting, and long range planning. It would also assist school trustees and others in decision making, improve the school's ability to evaluate its educational policy, and provide the school with data to assess the strengths and weaknesses of its educational program (Clayton,J.C, Jr. 1970).

In another document a plan was presented for development of a Rural Education Information System for the 10 states (in the United States of America), which comprise the Southeastern Regional Council for Educational Improvement. Since the Council considers its principal function to be support of educational policy analysis and formation in its member states, the information system design presented in this paper is oriented toward policy support (Hayman, John; Floyd, Mike, 1980).

2.3 Review Current System

The writer has attempted to locate a web based system that is similar to the proposed system in the Internet that was developed locally for retrieving the National Education Policy and its related documents with a search capability. But, the writer's attempt fails to spot any web based system that enable the users to search for National Education Policy until the date this document was submitted for approval.

In order to understand how the process of getting information regarding to National Education Policy from the user point of view, several current system have been studied. Since the proposed system is a web-based application, it is more appropriate to review more web sites than the stand-alone applications. Nevertheless, the actual system in the Policy Unit, of the EPRD of the Ministry of Education, Malaysia should be reviewed.

Below are the systems being reviewed:

- CDS/ISIS
- U.S. Department of Education
- Ministry of Education / Ministry of Training, Colleges and Universities, Ontario
- Minnesota House of Representatives, Education Policy Committee
- Educational Policy Analysis Archives, Arizona State University

2.3.1 CDS/ISIS

CDS/ISIS or Computerized Documentation Service / Integrated Set of Information Systems is a text based software that can enable users to search for require document based on their information needs. The user just has to type in the appropriate keyword(s) and the system will start looked for relevant document regarding to the user query.

After interviewing with the system officers in the in the Policy Unit, of the EPRD of the Ministry of Education, Malaysia, the writer found out that the unit uses CDS/ISIS as an information system to store and to retrieve documents related to the National Education Policy.

2.3.1.1 Personal Evaluation

Normally this type of system is command based so a user has to learn the command in order to user the system. This makes the information retrieval process inefficient. When the WINISIS (Windows based CDS/ISIS) was not developed, the Dos based CDS/ISIS system does not support windows interface that is user friendly. Thus, the users have to type a lot of commands into the computer in order to search for a document.

Even with the emergence of the network version of WINISIS, the system can only be used over a workgroup network in a Local Area Network (LAN). So, the system cannot be used in the Internet whereby users can access to information at any time, any where.

2.3.2 U.S. Department of Education on Education Policy

- **URL**: http://www.ed.gov/pubs/lengsreg.html#policy
- **Features**

  This web page has published the legislations, bills and policies of education of the United States of America in a html plain text format with hyperlinks on certain keywords in the published document. By clicking these hyperlinks, the user is presented with documents related to the keywords.

  The visitors of the web page can be linked to the search engine of the U.S Department of Education web site whereby the visitors can search the entire web site for documents related to education. From this web page, the visitor

can also visit others legislative web page for the latest development of bill debating.

- **Personal Evaluation**

  This web site is a comprehensive html plain text documents that publish the education policy of the United States of America, but a more systematic approach can be used to present the information published on the web site.

  This web page user interface is a bit massy due to the fact the web site provided a lot of information to the visitors. The main page of this web page contains a lot of information on latest news and current researches carried out on education.

2.3.3 Ministry of Education / Ministry of Training, Colleges and Universities, Ontario

- **URL**: http://www.edu.gov.on.ca/eng/welcome.html
- **Features**

  In this web page, the visitors can choose between English or French as the language for viewing the web page. Basically, this web site only provides a few links to the education polices of the country and some links to legislative information on current debating bill.

  A search can be done on the entire web site to locate documents required by the visitors, but the search is not limited to search for documents related to education policy.

- **Personal Evaluation**

  Since in Canada both French and English is used widely in the country, this web site provides the visitors with two version of language, one in English and one in French. It is good to have this feature because it will encourage more users to visit the web site.

This site is less informative if this site is compared with the site of U.S Department of Education but this web site has a good user interface. Thus, visitors might feel comfortable with the navigation in the site.

2.3.4 Minnesota House of Representatives, Education Policy Committee

- **URL**: http://www.house.leg.state.mn.us/comm/education/edhome.htm
- **Features**

  The web site provides the visitors with information on K-12 education and higher education. Besides that, the visitors can also locate the bills, which have been referred by the Education Policy Committee. Then, bill summaries and research reports can be presented to the visitors.

  A link to the search engine of the web site but only limited for locating legislative information such as bills, debated bills, approved bills and so on. This web page also provides a link to the Minnesota legislative web site.

- **Personal Evaluation**

  This web site focuses mainly on legislative information that was related to education. So by reading the legislative information presented in the web page, the visitors can extract some information related to education policy from the documents they have read.

  The interface of the web page is mainly hyperlink to some others web page that contains information related to legislative on education so visitors who are interested in this type documents can visit the web page.

2.3.5 Educational Policy Analysis Archives, Arizona State University

- **URL**: http://olam.ed.asu.edu/epaa/
- **Features**

  This web page provides visitors with a search mechanism for locating the documents that the visitors are interested in. The visitors can also browse for a document from one published journal to another.

  The visitors can send any suggestions and comments about the web page to the web administrator for review. The web page also provided an email address for visitors to submit their articles for enriching the web page's article database.

- **Personal Evaluation**

  This web site is suitable for those people who are doing analysis on education policy such as researcher, students, teachers and maybe policy maker.

  This web page is more suitable to use as a supporting document regarding the implementation of certain policy. Thus, it will prove that the planned policy is feasible and usable depending on the situation

During the process of reviewing current system regarding to education policy, the writer manage to found a web site that lists all the Federal Ministry of Malaysia. The Universal Resources Location or URL of this web site is http://www.molin4.com/government/federal_ministries.htm. This web site provides links to some of the departments and agencies under the control of certain ministry. Beside that, it also lists out the minister and deputy minister of each federal ministry.

The writer has managed to visit some of the ministries web site. After visited these site, the writer noticed that almost every ministry published government policies related to each ministry. Some of the ministries just preview the polices in HTML format like the Ministry of Information but some ministry such as the Ministry of Agriculture provided a search engine to let visitors of the web site to search for

information such as press release, policy, current development of certain project, event, information important to the public and lots more.

After visiting the Ministry of Education web site, the writer manages to find a web page containing higher education act and policies. The web page presented the published information in a plain html text format that can be viewed in either in Malay or English, which is less interactive but the background graphics of the web page is colourful.

From the writer point of view, this indicated that the government is trying to distribute information related to government policies to the public more effectively, and accurately. By doing so, the public will have more sources to gather information regarding the nation development process and have a clear picture of it. This will ensure the public have a clear mind of what the government is trying to achieve.

2.4 What is Information?

Information is data that have been put into meaningful and useful context and communicated to a recipient who uses it to make decisions. Information involves the communication and reception of intelligence or knowledge. It apprises and notifies, surprises and stimulates, reduces uncertainty, reveals additional alternatives or helps eliminate irrelevant or poor ones, and influences individuals and stimulates them into action. (Burch and Grudnitski, 1989)

Information consists of data. Images, text, documents and voice, often inextricably intertwined, but always organized in a meaningful context. A simple schematic that represent how we will think of information is shown in figure 2.1. Notice that data to be processed can be input, stored or both. Another point to remember is the cycle of receives the information and then makes a decision and takes action; this creates other actions or events, which in turn create a number of scatted data that are

captured and serve as input; and the cycle starts all over again. (Burch and Grudnitski, 1989)

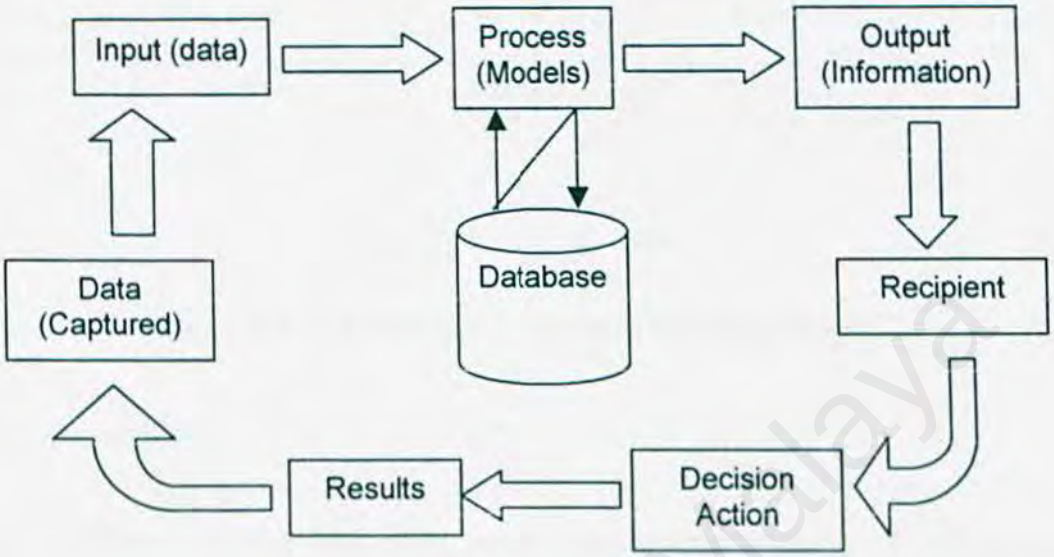

Figure 2.1 The Information Cycle

2.5 Information System

An information system can be defined technically as a set of interrelated components that collect (or retrieve), process, store, and distributed information to support decision making and control in an organization. Information system may also help managers and workers analyze problems, visualize complex subjects, and create new products. (Burch and Grudnitski, 1989)

All information systems are made up of the six building blocks of input, models, output, technology, database, and controls. These are basic building blocks of all information systems.

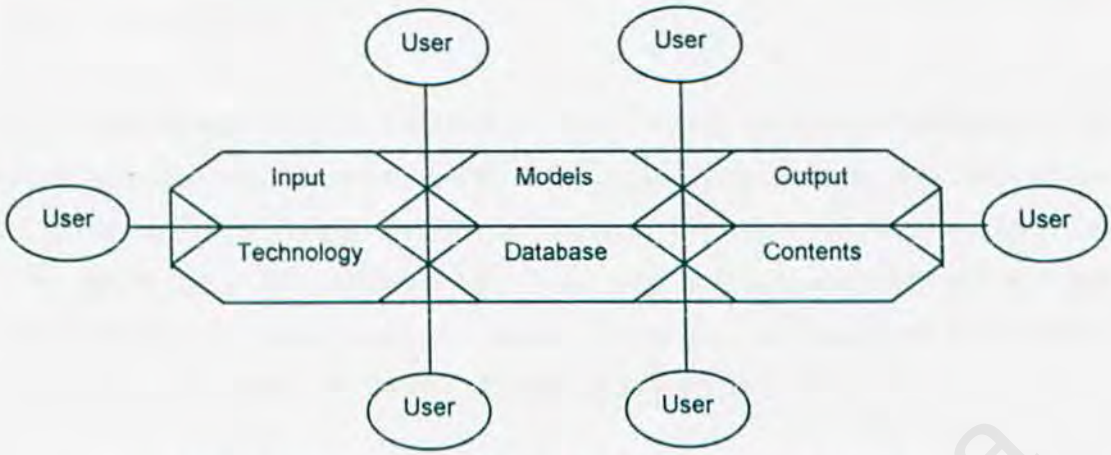

Figure 2.2 The Information System Building Blocks

2.5.1 Input Block

Input represents all the data, text, voice, and images entering the information system and the methods and media by which they are captures and entered. Input consists of transaction, requests, instructions, and messages. Generally, input allow protocol and format for paper content, identification, authorization, layout, and processing. (Burch and Grudnitski, 1989)

2.5.2 Models Block

This block consists of logical-mathematic models that manipulated input and stored data, in a variety of ways, to produce the desired results of output. The models block also contains a description of some of the more popular modeling techniques used by system analyst to design and document system specifications. The techniques include decision tables and trees, structured English, data flow diagrams and others. (Burch and Grudnitski, 1989)

2.5.3 Output Block

The product of the information system is output – quality information and documents for all level of users. To large extent, output is guiding and influencing block of the other blocks. If this block's design does not meet the needs of the users, then the other blocks are of little consequence. Often, input and output are interactive. Input becomes outputs; output becomes input. Output can be produced on screens, printers, audio devices, or microfilm. (Burch and Grudnitski, 1989)

2.5.4 Technology Block

Technology is the "toolbox" of information system work. It captures the input, drives the models, stores and accesses data, produces and transmits output, and helps control the total system. It does all the toil and grunt works and binds all the building blocks together. Technology consists of the three main components: the computer and auxiliary storage, telecommunication, and software (Burch and Grudnitski, 1989).

2.5.5 Database Block

The database is where all the data necessary to serve the needs of all the users are stored. It is treated from two viewpoints, physical and logical. The physical database

is made up of storage media, such as tape, disk, diskettes, and others. This is how data are actually stored. The logical side of the database is about how to search for, associate, and retrieve the data stored to meet specific information needs. (Burch and Grudnitski, 1989)

2.5.6 Control Block

All information system are subject to variety of hazards and threats. Some of the controls are designed into system to ensure its protection, integrity, and smooth operation. (Burch and Grudnitski, 1989)

2.6 Web-based application component

Developing the web-based application relies on many network and application components working together to deliver the information to the requesting clinet.

2.6.1 Web Browser

A web browser is a software program that acts as an interface between the user and the inner-workings of the Internet, specifically the World Wide Web. A browser is also referred to as a web client that acts in conjunction with a web server. The browser acts on behalf of the user by contacting a web server and requesting information and receiving information and then displaying it on the screen. (http://www.lib.utc.edu/pages/web4_browsers/sld01.html)
There are many different browsers. All perform the same basic functions (transferring hypertext documents), but many have specific features that are unique. Some commonly used browsers include Microsoft Internet Explorer, NCSA Mosaic, Netscape Navigator and Spry Mosaic. The first browser for the web was Mosaic. This browser developed by Mark Anderson in1993. (http://helpdesk.uvic.ca/resource/network/www.html)

Browsers can be text-based or graphical. A graphical browser allows the user to see more of what the WWW has to offer (graphics, photographs and multimedia) and

can make the Internet easier and more intuitive to use. (http://www.lib.utc.edu/pages/web4_browsers/sld01.html)

A text-based browser allows a user to see only text. Graphic elements are not displayed. Hypertext links are accessed by using the keyboard rather than a mouse. LYNX is an example of a text-based browser.

2.6.2 Web Server

A web server is a software program running on a computer connected to the Internet. The term "web server" is also used sometimes to refer to the computer on which the software is running. More often, the computer is called a server and is running more software than just web server software. (http://telcom.coos.k12.or.us/WhatIsTheWWW/server.htm) Some examples of Web Server are MS Internet Information Server for Windows NT, Personal Web Server for FrontPage, Netscape Enterprise Server and Apache. (http://slatertech.com/intranetting/tsld007.htm)

The purpose of a web server is to respond to request for WWW files. When the users surf the WWW, users are sending requests to web servers all over the country or world. The servers are sending back various files and used to construct the web pages the users see. (http://telcom.coos.k12.or.us/WhatIsTheWWW/server.htm)

When a Web browser tries to access the information stored in a database, Web server acts as the client to the Database server. The Web server accepts the query from the browser and passes the query to the Database server. Moreover, the Web server also formats the results into HTML, and sends the results back to the browser.

2.6.3 Database Server

A computer and software application that uses the client/server technology to distribute the processing of data in the database between the server and client computers. (http://slatertech.com/intranetting/tsld007.htm)

2.7 Database on the Web

The ability of Web-based application to access database is the key to corporate application development on the web. Existing cooperate database can be accessed via the Web, providing unparalleled information to access. Finally, pre-existing applications that have more traditional components for information input and updating can be augmented with a Web-based front end. These types of solutions allow corporations to take advantage of the Web while still leveraging their previous development investments.

Scalability of any application server, Web server, and database server allows someone to develop a simple Web application solution for a large-scale production system. Choosing the correct set of technologies for an information system project will lead to an effective solution developed in a cost-effective manner, that can take advantage of the client/server scalability and integrate new technologies as they emerge.

2.8 Client/Server Concept

2.8.1 What is Client/Server?

Client/Server systems allow many people to share centralized data. This requires a network of personal computers (PCs), which are the "clients" to be linked to a central computer, known as the "server". Any kind of data (address, values, codes, phone numbers and so forth) can be stored in a database on the server. The database is accessed with a software application that runs on clients PCs. Sometimes the work of the application is done on the server, and sometimes it is done on the PC – this functionality is more efficient than traditional computer systems because work can be taken from the server, computed locally with a PC, then moved back to the server. This process is not so taxing on the PCs or the

server because they share data, leading to more efficient use of computing resources. (http://www.faqs.org/faqs/client-server-faq/index.html)

Applications used in client/server systems are usually of the Graphical User Interface type, or "GUI" (pronounced "gooey"). This type of application is usually in a Windows™ format, so you can either use a mouse to point-and-click through the application or navigate with keystrokes. GUI applications are much easier to use than traditional mainframe-based applications, which leads to increase productivity and quality, as well as a reduced training investment. (http://www.faqs.org/faqs/client-server-faq/index.html)

2.8.2 What is a Client process?

The client is a process (program) that sends a message to a server process (program), requesting that server perform a task (service). Client programs usually manage the user-interface portion of the application, validate data entered by the user, dispatch requests to server programs, and sometimes execute business logic. The client-based process is front-end of the application that the user sees and interacts with. The client process contains solution-specific logic provides the interface between the user and the rest of the application system. The client process also manages the local resources that the user interacts with such as the monitor, keyboard, workstation CPU and peripherals. One of the key elements of a client workstation is the graphical user interface (GUI). Normally a part of operating system, for example the windows manager detects user actions, manages the windows on the display and displays the data in the windows. (http://www.faqs.org/faqs/client-server-faq/index.html)

2.8.3 What is a Server process?

A server process (program) fulfills the client request by performing the task requested. Server programs generally receive requests from client programs, execute database retrieval and updates, and manage data integrity and dispatch responses to client requests. Sometimes server programs execute common or

complex business logic. The server-based process "may" run on another machine on the network. The server could be the host operating system or network file server; the server is then provided both file system services and application services. The server process acts as a software engine that manages shared resources such as databases, printers, communication links, or high powered-processors. The server process performs the back-end tasks that are common to similar applications. (http://www.faqs.org/faqs/client-server-faq/index.html)

2.9 Client/Server Architecture

Though client/server architecture can be very complex, there are generally speaking, two kinds of client/server infrastructures to choose from. They are two- and three-tiered. The choice between a two- and three-tier architecture should be based on the scope and complexity of a project, the time available for completion, and the expected enhancement or obsolescence of the system. (http://www.personal.kent.edu/~jnattey/spag11.htm)

2.9.1 Two-Tier Architecture

The two-tiered architecture contains two computers-a client, and a server-with areas of logic combined on the client. The three components of an application-presentation, processing, and data-are divided among two software entities or tiers: client application code and database server. A robust client application development language and a versatile mechanism for transmitting client requests to the server are essential for a two-tier implementation. Presentation is handled exclusively by the client, processing is split between client and server, and data is stored on and accessed through the server. The PC client assumes the bulk of responsibility for application (functionality) logic with respect to the processing component, while the data base engine-with its attendant integrity checks, query capabilities, and central repository functions-handles data intensive tasks. In a data access topology (see Figure 2.3), a data engine would process requests sent from the clients. Currently,

the language used in these requests is most typically a form of SQL. To send the SQL, the client must know the syntax of the server or have it translated by an

API(application program interface). Data returned to the client can be manipulated at the client level for further sub selection, business modeling, what-if-analysis, and reporting.

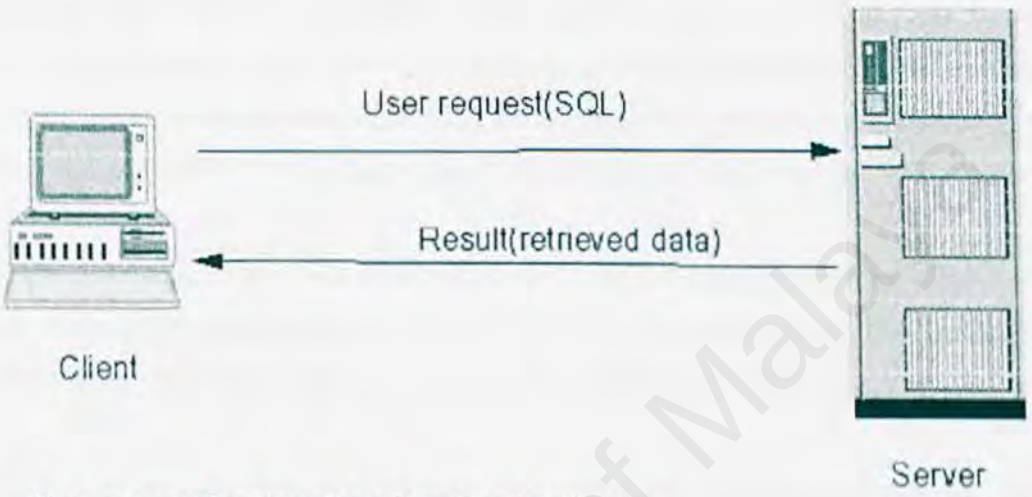

Figure 2.3 2-Tier Architecture

2.9.1.1 Advantages Of Two-Tier System

1.Application development speed is the most compelling advantage of a two-tier environment. In most cases, a two-tier system can be developed in a small fraction of the time it would take to code a comparable but less-flexible legacy system.

2.Most tools for two-tier are very robust and lend themselves well to iterative prototyping and rapid application development (RAD) techniques, which can be used to ensure that the requirements of the users are accurately and completely met.

3.Two-tier architectures work well in relatively homogeneous environments with fairly static business rules. They are less suitable for dispersed, heterogeneous environments with rapidly changing rules.

2.9.1.2 Disadvantages Of a Two-tier System

1.Because the bulk of application logic exists on the PC client, the two-tier architecture faces several potential version control and application redistribution problems. A change in business rules would require a change to the client logic in each application in a corporation's portfolio affected by the change.

2.System security in the two-tier environment can be complicated because a user may require a separate password for each SQL server accessed. The proliferation of end-user query tools can also compromise data base server security.

3.Client tools and the SQL middleware used in two-tier environments are also highly proprietary, and the PC tools market is extremely volatile. The volatility of the client/server tool market raises questions about the long-term viability of any proprietary tool an organization may commit to and complicates implementation of two-tier systems.

2.9.2 Three-Tier Architecture

The components of three-tiered architecture are divided into three layers: a presentation layer, a functionality layer, and the data layer. Each of these layers must be logically separate. The three-tier architecture (see Figure 2.4) attempts to overcome some of the limitations of the two-tier scheme by separating presentation, processing, and data into separate distinct entities. The same types of tools can be used for presentation as were used in a two-tier environment, however the tools are now dedicated to handling just the presentation. When the presentation client requires calculations or data access, a call is made to a middle-tier functionality server. This tier performs calculations or makes requests as a client to additional

servers. The middle-tier servers are typically coded in a highly portable, nonproprietary language such as C. Middle-tier functionality servers may be multithreaded and can be accessed by multiple clients, even those from separate applications. Although three-tier systems can be implemented using a variety of technologies, the calling mechanism from client to server in such a system is most

typically the remote procedure call, or RPC (remote procedure call). Because the bulk of two-tier implementations involve SQL messaging and most three-tier systems utilize RPCs, examination of the merits of these respective request/response mechanisms is warranted.

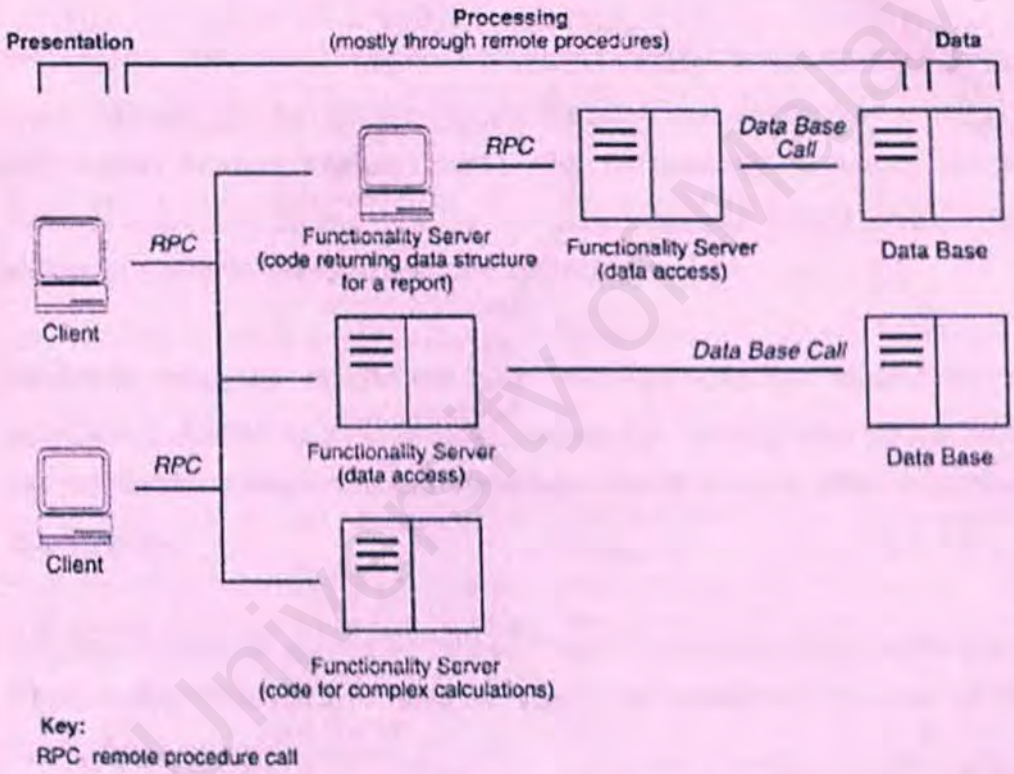

Figure 2.4 3-Tier Architecture

2.9.2.1 Advantages of a Three-Tier Architecture

1.RPC calls from presentation client to middle-tier server provide greater overall system flexibility than the SQL calls made by clients in the two-tier architecture. This is because in an RPC, the requesting client simply passes parameters needed for the request and specifies a data structure to accept returned values.

2.Unlike in most two-tier implementations, the three-tier presentation client is not required to understand SQL. As such, the organization, names, or even the overall structure of the back-end data can be changed without requiring changes to PC-based presentation clients. Because SQL in no longer required, data can be organized hierarchically, relationally, or in object format. This added flexibility allows a firm to access legacy data and simplifies the introduction of new data base technologies.

3.Having separate software entities allows for the parallel development of individual tiers by application specialists.

4.Provides for more flexible resource allocation. Middle-tier functionality servers are highly portable and can be dynamically allocated and shifted as the needs of the organization change. Network traffic may be reduced by having functionality servers strip data to the precise structure required before distributing it to individual clients at the local area network (LAN) level.

5.Modularly designed middle-tier code modules can be reused by several applications. Reusable logic reduces subsequent development efforts, minimizes the maintenance workload, and decreases migration costs when switching client applications.

6.A three-Tier system such as Open Software Foundation's Distributed Computing Environment (OSF/DCE) offers a variety of additional features to support distributed applications development.

2.9.2.2 Disadvantages of Three-Tier Architectures

1.Three-Tier brings with it an increased need for network traffic management, server load balancing, and fault tolerance.

2.Current tools are relatively immature and require more complex 3GLs for middle-tier server generation. Maintenance tools have underdeveloped facilities for

maintaining server libraries a potential obstacle for simplifying maintenance and promoting code reuse throughout an IS organization.

2.10 Database Access Methods

Today's Web database development tools offer several strategies for accessing a corporate database from within a browser. Web-enabled RAD solutions run in your browser via plug-ins or ActiveX controls; HTML mixed with ActiveX or Java is the most typical approach to database design; and pure HTML provides an extremely thin client. Some tools offer you the choice of deploying your applications using any of these options.

2.10.1 Rapid Application Development (RAD) Tools Model

In this solution, RAD tool forms can be displayed inside a browser using plug-ins such as PowerBuilder 5.0 or ActiveX controls such as Visual Basic 6.0. The client accesses the database directly, so users need database drivers in addition to the plug-ins or controls, resulting in a much fatter client than with other approaches.

Figure 2.5 RAD Tools Model

In diagram figure 2.5, the Web server and the database function essentially independently of each other. Some products use pooled database connections to attempt to improve server-side performance. (http://www.zdnet.com/pcmag/features/webdatabase/sb1.htm)

2.10.2 Mixed-components Model

Using this model, the server renders the look and feel of the interface in HTML and forms built using ActiveX or Java components, or a combination. No database drivers are needed, but users do need to download some components, creating a moderately chubby client, a disadvantage of this method is that not all browsers support different components.

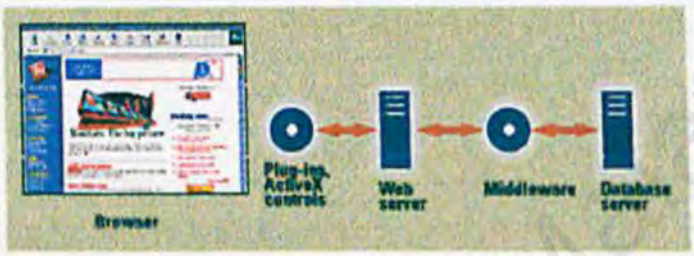

Figure 2.6 Mixed-components Model

Referring to figure 2.6, as the browser requests pages, the Web server can access the database through a variety of means, including CGI, Microsoft Active Server Pages (ASP), or Java. Some products offer middleware that makes the process more efficient by coordinating transactions. (http://www.zdnet.com/pcmag/features/webdatabase/sb1.htm)

2.10.3 Pure HTML Model

This approach offers the widest access for Web users and the thinnest client. The server creates the user interface in standard HTML, Javascript, or both. In the current roundup, Microsoft, Netscape, and Oracle offered this option.

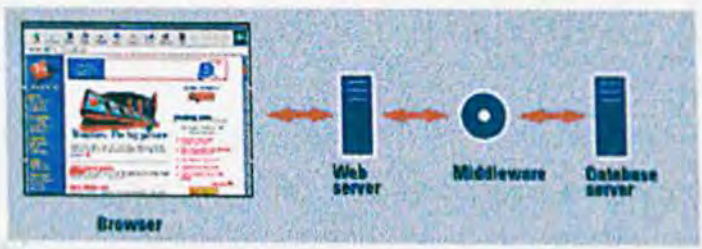

Figure 2.7 Pure HTML Model

The Web server conducts all interaction between the client and the database; again, middleware may be used to improve the efficiency of transactions. The server employs CGI scripts, ASP, or Java to generate HTML based on information from the database. (http://www.zdnet.com/pcmag/features/webdatabase/sb1.htm)

2.11 Tools and Technologies Consideration

The following are the tools and technologies will be considered before the implementation:

- Development Platform
- Database Management System
- Messaging Management System
- Data Access Technology
- Web Development Technology
- Others

2.11.1 Development Platform

Different types of application will run in different platform or environment. However, most of the application available in the market will only support one single type of platform. Following are the platform that takes into consideration:

2.11.1.1 Windows NT Server

- Microsoft Windows NT is one of the powerful operating systems for business computing. It combines the ease-of-use of Windows 95/98 with the power and reliability of Window NT. NT is also a powerful OS that reliable, secure, multithreaded, symmetric processing, support client/server system. (Cowart, 1997)
- There is an extensive security support in NT. NT can control the access control of user in accessing certain file or application. This can use for implemented the access control for the Attendance Management System. Besides, NT supports a

wide range of networks protocol and Remote Access Protocol. This makes it easy for us to develop the distributed application.

- Windows NT Server is a complete platform available for building and hosting web-based application. It is the best platform to publish and share information securely over corporate Intranet and Internet. It is so reliable that when an application have problem it doesn't crash the whole program.
- Windows NT allows Object Linking and Embedding (OLE). It can combine the information from several applications into one compound document using the special OLE capabilities of window-based application.
- Window NT also enables the capabilities of integrating applications on a single computer or even across multiple computers.

2.11.2 Database Management System

Database technology is used in a variety of applications. Some serve only a single user on a single computer while others are for multi user. By using reliable database management system, the consistency and accuracy of data can be ensured. There are a variety types of database like Microsoft SQL Server 7.0, Oracle 8i, Sybase, Informix and also Microsoft Access.

In order to choose a reliable database, the database must be able to ensure the safety and security of the data. The database is at the core of all mission-critical business applications. Choosing the wrong database can have drastic downstream results. The investment in software, implementation, and development of a database system is substantial; it needs to be able to evolve with the changing requirements of a growing company.

2.11.2.1 Microsoft SQL Server 7.0

- Microsoft SQL Server is a significant tool in many regards. From data warehousing to applications that require not only a large amount of information, but also many different simultaneous users, SQL server is a key component in

answering data management requirement. It is a powerful and comprehensive database. (Wynkoop, 1999)

- Microsoft SQL Server is a perfect example of an n-tier system. The user can manipulate the data directly from the client side. Most of the time, the data is validated first before it is updated into the database in server side. It is tightly integrated with the Microsoft BackOffice family product to enable organization to improve decision-making and streamline the business process. It is the best database for Windows NT Server.
- Microsoft SQL Server maintains referential integrity and security and ensures that operation can be recovered in the event of numerous types of failure. SQL server can control the access for the type of information that can be retrieved by the user.
- SQL Server supports Internet database integration. It allows the user to automate the publishing of database information in HTML documents. It allows us to build active web sites and let us conduct processes on the Internet. When combining with Internet Information Server and the SQL server Internet Connector, it gives user the complete Internet database publishing capabilities.
- It provides the function for transparent distributed transactions. This means that it provides automatic distributed update capability across two or more SQL Server transparent to the desktop application, making it a simple to use. It guarantees the integrity of transaction of updating spanning multiple servers.

2.11.3 Messaging Management System

Messaging management becomes a very important task in the computing environment. The organization started to exchange information through the use of electronic document like email and other related document. We had to study some of the messaging system and then choose the tools that can be integrated into the system.

2.11.3.1 Microsoft Exchange Server 5.5

- Microsoft Exchange Server is a powerful messaging system that enables members of one organization to exchange information with users on the Internet and other systems. Users can send documents, spreadsheets, graphics and other items in a single email to other users. (Guaraldi, 1998)
- It provides high level of performance and advanced security features. It is very easy to manage and it provides a set of tools that help the administrator to manage the system efficiently.
- It provides tool for building collaborative applications that take advantage of the messaging platform by using the combination of Exchange Server and Microsoft Outlook.
- It supports trusted message sent between offices so that the users can verify the source of messages sent from another office.
- It enhanced protocol support for the Internet mail service like Secure Multipurpose Internet Mail Extensions (S/MIME), Secure Sockets Layer (SSL) and also the Simple Authentication and Security Layer (SSL).
- It used an updated database that provides more robust data storage capabilities.
- It can create virtual networks by connecting the Exchange Server together over the Internet. It will avoid expensive WAN and dial-up charges.

2.11.4 Data Access Technology

Data assessment is very important for each application. In order to access, retrieve and share information efficiently throughout a certain environment, data access technology that provides us with a lot of functionality have to be review first. It provides us with ease-to-use, programmatic access to all types of data throughout the enterprise. It is easy to integrate information from a variety of sources, which is relational (SQL) and non-relational. These components can be used by the data driven client/server applications deployed over the Web or LAN.

There are many types of data access technologies, which are VB SQL, Open Database Connectivity (ODBC), Java Database Connectivity (JDBC), Data Access Object (DAO), Remote Data Object (RDO), ActiveX Data Object (ADO) and OLE-DB.

2.11.4.1 Open Database Connectivity (ODBC)

Open Database Connectivity is one method that used by Windows™ application to communicate with client/server databases. It is a component of Microsoft's Windows Open System Architecture (WOSA). It provides a set of application program interface (API) functions, which makes it easier for us to connect to a wide range of database formats, that is it supports SQL. We can also access a number of PC databases using ODBC functions.

ODBC is based on the X/Open Call-Level Interface and uses SQL. During the run time, ODBC driver will communicate with other drivers and through a standard interface called Service Provider Interface (SPI). It is a network independent technology because it employs replaceable network libraries. Figure 2.8 shows the ODBC architecture. (Mueller, Paul, 1998)

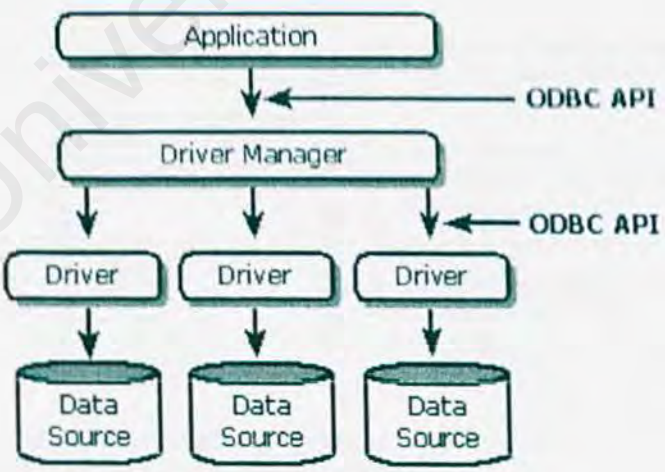

Figure 2.8 ODBC Architecture: The Application on Top of it.

However, the biggest downside to ODBC is that it must be able to support the capability to translate calls. This means that additional processing overhead can slow the data access a bit.

2.11.4.2 ActiveX Data Objects (ADO)

The ADO is based on an object model that exposes the collections, methods and properties necessary to access and work with the database. This object model is available from ASP code and works conjunction with the OLE DB layers. It is a new technology for data access based on existing technologies and endowed with increased flexibility. It is an evolution of both DAO and RDO into a single, simplified and extensible interface that will supersede all DB-Library, DAO & RDO functionality. (Siler, Brian, 1998)

ADO focuses primarily on Internet deployment because it has the ability to maintain its current state in a connectionless environment. It includes implementation with full data manipulation capability and a downloadable, lightweight implementation available to Internet clients at runtime. ADO base in ASP application, works using the ODBC driver to connect SQL Server. Figure 2.9 shows the connection between the ADO in ASP, driver and database. (Wynkoop, 1999)

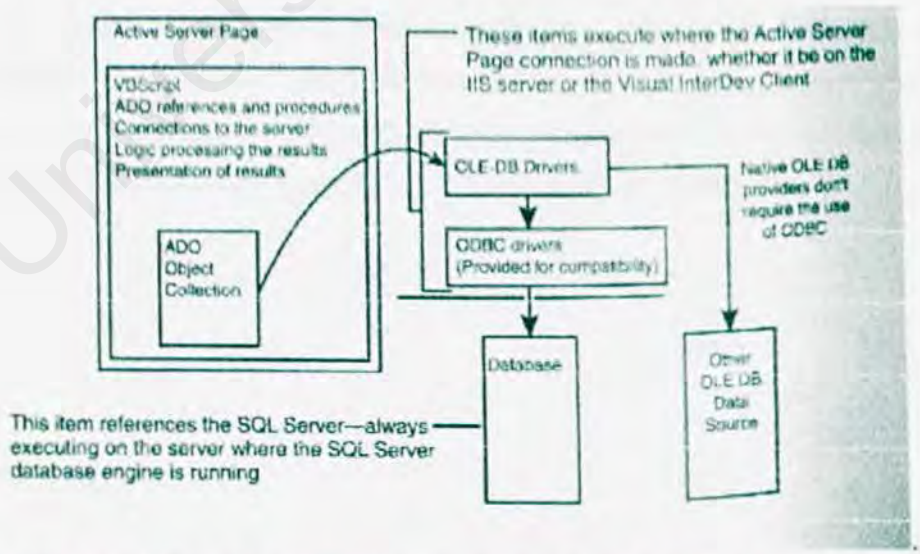

Figure 2.9 Flow of ADO Connection to Database and Data Sources

2.11.4.3 OLE-DB

OLE-DB is Microsoft's new low-level database interface that provides access to much different kind of data. It is the extension of application capabilities beyond the

limitations of ODBC. OLE DB is a set of Component Object Model (COM) interfaces that provide applications with uniform access to data stored in diverse information sources and that also provide the ability to implement additional database services. These interfaces support the amount of DBMS functionality appropriate to the data store, enabling it to share its data. (http://msdn.microsoft.com/library/default.asp?URL=/library/psdk/sql/9_ole_25_1.htm)

2.11.5 Web Development Technology

Developing web-based applications relies on many network and application components working together to deliver information to the requesting client. In the once, only web browser extracted information from the web server. However, after some standardization of HTML languages, image specification and protocol stacks, the world become a global network of computer.

To transform the global network into a reliable application, the original architecture of the web must be enhanced to meet the needs that we take for granted when developing traditional applications. Figure 2.10 shows the enhanced architecture to deploy and develop web-enabled applications. (Johnson, Scot, 1997)

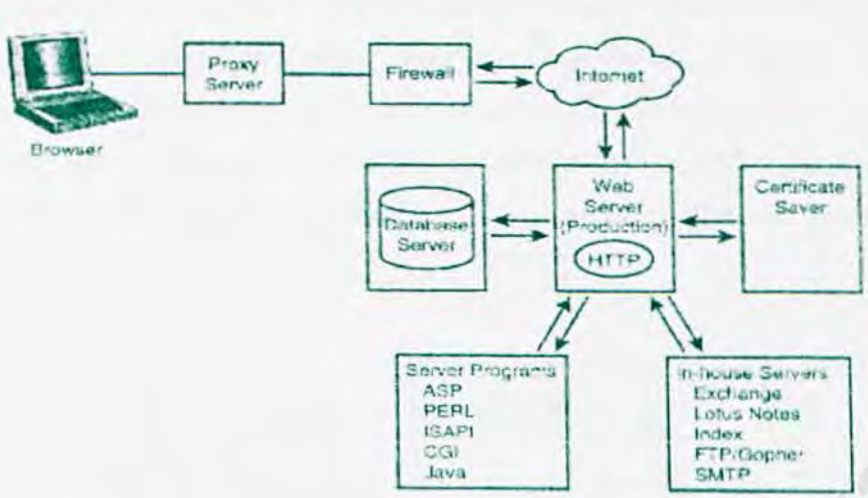

Figure 2.10 Evolution Web Architecture for Web-enabled Application

2.11.5.1 Internet Information Server 4.0

Microsoft Internet Information Server (IIS) provides a transactional-based Web server that is tightly integrated with the NT operating system. The advantages of IIS can be separated into two camps, which are the improvement in HTTP-related service areas and the additional functionality in managing and developing application functionality. The advancements in the HTTP services area enable IIS to manage multiple Web sites, tailor site or application specific settings. It enables HTTP 1.1 support. The advancement for the application development side includes transactional-based applications, process isolations, SSL support, ActiveX Data Object (ADO) and new development tools. (Mueller, Paul, 1998)

The benefits of IIS can be seen by the services it provided. IIS provides a high-speed, secure platform for publishing information on internal networks or Internet. The server is specifically designed to provide the kind of performance that is necessary for handling an increased number of web users and users who are connected with high-speed links, such as ISDN and leased lines.

The Transactional Active Server Page feature of IIS allows application with scripts and components to perform multiple actions. If a failure occurs during a particular transaction, IIS automatically backs up the server to the start of the transaction, allowing the user to recover from a failure without any loss of data. Figure 2.11 shows the Internet Database Connector (IDS) provided by the IIS. (Mueller, Paul, 1998)

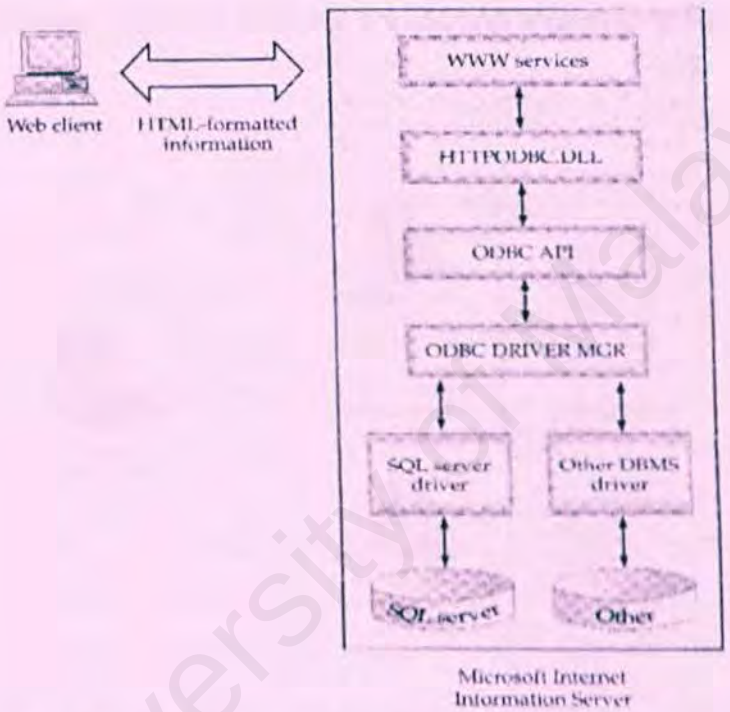

Figure 2.11 Web Server Database Connectivity using IDS

After we choose Windows NT 4.0 as the platform, IIS will serve as a platform for web tools and applications for the Attendance Management System. IIS provides configuration and management of properties such as access permissions and logon requirement for clients, home and virtual directories, virtual servers. This option will be needed in the implementation of this project.

2.11.5.2 Active Server Page

Active Server Pages (ASP) is a component of Microsoft's Web server software that allow user to embed server-side script code in Web pages. It is a server side enhancement because all the script code runs on the server. The users can now create web sites that are dynamic and database-driven by using the client side script, Java applets, dynamic HTML, or Active X Control. Figure 2.12 shows the Active Server Page architecture that can be used and apply in the existing network. It shows us that there is various ways for the client to access information. (Johnson, Scot, 1997)

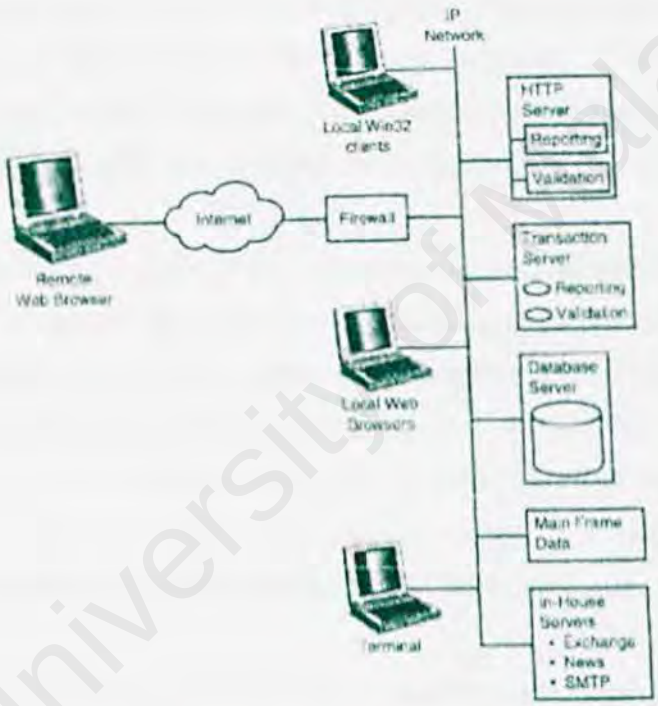

Figure 2.12 Active Server Page Architecture

Following are some of the benefit of Active Server Page:

- It works with Window NT and IIS to provide a comprehensive set of technologies that enable secure exchange of information over public networks, access control to server resources and confident identification of server and client.

- It supports client/server programming. Thus, it can be used to build client/server applications.
- It is suitable for building multi-tier Internet and intranet applications.

After looking at the benefit and the architecture of the Active Server Page, it has been considered for the development of the project.

2.11.5.3 Jscript

Jscript is the Microsoft® implementation of the JavaScript scripting language. It is a full implementation, plus some enhancements that take advantage of capabilities of Microsoft Internet Explorer. This tutorial is intended to help you get started with Jscript. (http://asp-help.com/getstarted/ms/jscript/301.htm) A programmer can create certain Active Server Page with Jscript and certain Active Server Page with VBScript, depending on which language is more appropriate.

Jscript was designed as a general purpose scripting language that would appeal to the world many programmers who use C, C++, and Java. This means that it "borrows" features from these languages where appropriate, but is a language in its own right and includes many features not found in C or Java. It's important to note that Jscript is not just confined to use in the browser; you can use Jscript in most applications in which you can use VBScript. (http://msdn.microsoft.com/workshop/languages/clinic/vbsvjs.asp)

Jscript is very good language to use as a client-side programming language. Unlike VBScript, Jscript create client-side scripts that the majority of recent browsers can recognize. Both Netscape Communicator and Internet Explorer can interpret and execute HTML files that include Jscript.

2.11.5.4 Visual Basic Scripting

Visual Basic Scripting is a lightweight scripting language that provides programming functionality based on the Visual Basic programming language. It is natively executed on the Internet Explorer browser and can be executed in the browser

through plug-in technologies. It is the default scripting language for the IIS. (Mara, Jane, 1997)

VBScript lets the user interact with a Web page rather than simply view it. VBScript can take input from the user and check the data to make sure it is valid or meets certain criteria. Then, it can put an Internet server to work either by actually storing the data or causing some action to take place on the server based on the information given.

VBScript also play an important role in many ways, including validating data, pricing, providing impressive multimedia feedback, and initiating data storage. The user can use VBScript to sequence the questions based on responses. VBScript can perform calculations on data, such as computing the cost of an item after taking into account the sales tax.

Another important aspect of this programming model is that it let us use the intrinsic HTML form controls and Microsoft's ActiveX controls with VBScript to give Web pages an attractive look and feel. Intrinsic HTML form controls, a timer control that enables us to time events on Web pages and a pre-load control that lets us load bitmaps can be created. The users can create 3-D animation effects, making the Web page come alive with moving objects in response to certain events. Figure 2.13 shows the VBScript-Host model.

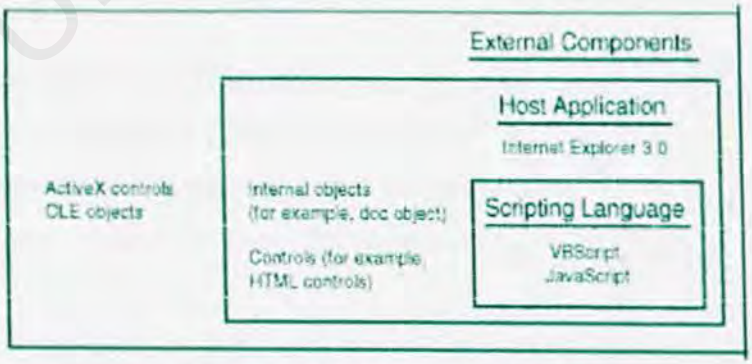

Figure 2.13 VBScript-Host Model

2.11.5.5 HTML

Without HTML, the World Wide Web wouldn't exist. HTML allows the individual elements on the Web to be brought together and presented as a collection. HTML isn't the only way to present information on the Web, but it's the glue that holds everything together. In addition to being a markup language for displaying text, images, and multimedia, HTML provides instructions to Web browsers in order to control how documents are viewed and how they relate to each other. For all its simplicity, HTML is a very powerful language.

The users can add many functions inside HTML. They can add their own VBScript and also JavaScript inside HTML to make it become a dynamic HTML. Besides displaying information, they can show database record in the Internet and get response from other users.

2.11.6 Others

2.11.6.1 Active X

ActiveX is the set of technology developer uses to write software components that inter-operate, regardless of the language used to create them. For example, these ActiveX applications can be written using C++, Java, Visual Basic, and Delphi. (Husain, Kamran, 1997) The real power of ActiveX comes from its consistent, comprehensive implementation. This means that with the same component-based approach a developer can:

- Script objects inside an HTML page.
- Assemble interfaces for Windows applications.
- Communicate between client and server components.
- Script business rules or Web server applications.

Following are some main reasons why ActiveX is being considered in this project:

- ActiveX is reusable in other applications.
- ActiveX is created specifically for Internet development, which is very important for developing the web-based applications in NEPIS project.
- ActiveX provides different types of ActiveX components that could be used in different project types.
  - Classes, which enables reusable, systematic and organized coding
  - ActiveX DLLs (in process), which offers sharing capability amongst the applications.
  - ActiveX EXE (out process), which can be created and used both by client and server applications
  - ActiveX Controls, which are compatible with many containers, including Microsoft Office Applications and Internet Explorer
  - ActiveX Document (Doc Objects), which associates data in a document file with a user interface object. Therefore, this allows distribution of arbitrarily complex data across the Internet and Intranet.

2.11.6.2 ActiveX DLL

ActiveX DLL is use to add functionality to an HTML page on either the client or server. Code components on the client can offer an increase in speed, since users' commands do not need to be routed back to the server. Server components also have the benefit of being able to show user interface elements. ActiveX DLL files can be made to become an ASP component that can be run in the web server. The ActiveX DLL is used when the functionality of the Visual Basic is not available for the visual basic scripting in ASP. (Husain, Kamran, 1997)

2.12 Summary

After reviewing all the web site in this chapter, it is appropriate to have the proposed system provided the users with informative information about the education policy in Malaysia. The proposed system is only focus on education policy, so it should deals with information related to this particular area only.

The most important part of the proposed system is to have a search capability so that the users of the system can look for the related document more easily and effectively. This means that the searching mechanism should be as power as possible to enable a more relevant search based on the queries the users provided.

It is also important to have a user friendly user interface so that the users of the system feel easy when browsing for information. Information provided by the proposed system should be well categorized in order to have a clean and neat user interface, thus this will let the users of the system locate the necessary information easily.

Since in Malaysia both Malay and English language are used widely in the public and private sector, it is a good design to have the proposed system to have both language covered. Then, the users of the system can choose one of the two languages provided. This will enable the users who are not good with English can use the system in Malay and vice-versa.

In this chapter, the write has reviewed the existing system based on certain criteria such as the features provided by the system. Furthermore, reviews on concepts and system development technologies that are used in developing the proposed system are discussed in detail in this chapter. Then in the next chapter the writer can present the system requirement and analysis to the reader.

CHAPTER 3: System Requirement and Analysis

3.1 Introduction

In the process of developing the proposed system, system requirement is crucial because in this phase all the necessary information of the proposed system is gathered. Under the system requirement, the needs of the users of the proposed system are defined. The reader plans for a broad outline of the system, the technology to be used and the expected cost of the system.

3.2 Requirement Gathering

Before all the require information for developing the proposed system is captured, a few data gathering techniques have been used to find out what the users really want. The requirement gathering process take quite a long time due to several techniques are applied in order to get a complete requirement. Following are some of the techniques that have been used for this purpose:

- Review of the current situation
- Interview
- Reading
- Internet Research
- Brainstorming

3.2.1 Review the current situation

In order to get a full understanding of the current situation on how the system actually works, a review on current system and process of gathering information regarding education policy has been done. This review helps to build a more user-friendly system to help the users to search for information in a more efficient and effective way.

3.3 Methodology

In the developing the proposed system, the writer decided to use a combination of two development methodology that are the Waterfall model and the Prototype model. By using combination of the two development model, the writer hopes to get the best results in developing the proposed system.

3.3.1 Waterfall Model

People and projects following an engineered approach to software development generally pass through a series of phases, or stage. Figure 3.1 shows the original model of the Waterfall model.

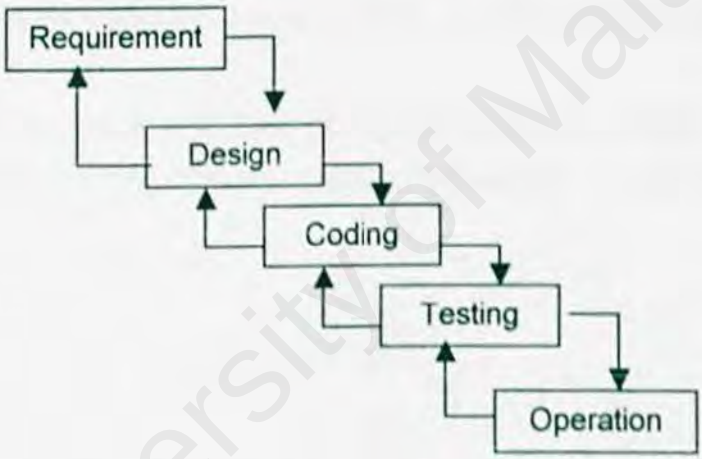

Figure 3.1 Standard Waterfall Life Cycle Model

The stages are depicted as cascading from one to another. One development stage will be completed before going down to the next stage. The Waterfall Model presents a very high level view of what is going on during the development and if suggests to developers the sequence of events they expect to counter.

The waterfall model can be very useful in helping developers lay out what they need to do. Its simplicity makes it easy to explain to customers who are not familiar with software development. It makes explicit which intermediate products are necessary in order to begin the next stage of development (Pfleeger, 1998).

Linear cycle phases of waterfall model cycle are chosen to encourage top-down problem solving. Designers must first define the problem to be solved and then use an ordered set of steps to reach a solution. The linear cycle gives the project direction, and provides guidance on what should be done as the project proceeds. It is integrated with the management process through reports on project status and keeping track of resource needs (Hawryszkiewycz, 1998).

3.3.2 Prototype Model

The development strategy used in NEPIS is the software prototyping methodology. This methodology was chose because there was a high degree of uncertainty in several areas in the system requirements. The emphasis is on trying out ideas and providing assumptions about the requirements, not on system completeness.

Prototyping is a process that enables the developer to create a model of the software that must be built. This prototyping model consists of six steps as shown in figure 3.2.

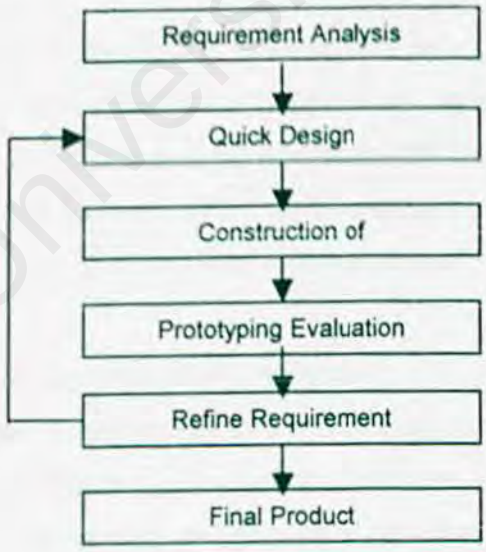

Figure 3.2 The Prototyping Model

Like all approaches in software development, prototyping begins with requirements gathering. After identifying the known requirements, a quick design is then formulated. The quick design focuses on the top-level architecture and data design issues, rather than on detail procedural design. Later the quick design leads to the construction of a prototype. The prototype is tested and evaluated to refine the requirements and maybe additional requirements. A process of iteration occurs until all requirements are formalized or until the prototype has evolved into a production system.

The prototype model is used because

- Change can be made early in development.
- System developed can meet users' needs more easily.
- It provides a common baseline and frame. Developers and users can communicate better.
- The developer can understand the system much better.

3.3.2.1 Advantages of Prototyping

i) *Changing the early in its development*

Successful prototyping depends on early and frequent user feedback to help modify the system and make it more responsive to actual needs. As with any systems effort, early changes are less expensive than changes made late in the project's development.

ii) *Scrapping undesirable systems*

A second advantage of using prototyping is the possibility of scrapping a system that is just mot what users and analysis had hoped. Once again, the issue of time and money spent arises. A prototype represents much less of an investment than a completely developed system.

iii) Designing a system for users' needs and expectations

A third advantage of prototyping is that the system being developed should be a better fit with users' needs and expectations. Many studies of failed information systems indict the long interval between requirements determination and the presentation of the finished systems while sequestered away from users during this critical period.

3.3.2.2 Disadvantage of Prototyping

i) Managing the project

Although several iterations of the prototype may be necessary, extending the prototype indefinitely also creates problems. It is important that the systems analysis team devises and then carries out a plan regarding how feedback on the prototype will be collected, analyzed, and interpreted. Set up specific time periods during which you and management decision makers will use feedback to evaluate how well the prototype is performing.

ii) Adopting an incomplete system as complete

A second major disadvantage of prototyping is that if a system is needed badly and welcomed readily, the prototype may be accepted in its unfinished state, and pressed into service without necessary refinement. While superficially this may seem an appealing way to short circuit a lot of development effort, it works to the business and team's disadvantage.

3.3.3 Incremental Model

The incremental model combines elements of the linear sequential model (applied repetitively) with the iterative philosophy of prototyping. As Figure 3.3 shows, the incremental model applies linear sequences in a staggered fashion as calendar time progresses. Each linear sequence produces a deliverable "increment" of the software (McDermid, 1993). For example, word-processing software developed using the incremental paradigm might deliver basic file management, editing, and document production functions in the first increment; more sophisticated editing and document production capabilities in the second increment; spelling and grammar checking in the third increment; and advanced page layout capability in the fourth increment. It should be noted that the process flow for any increment can incorporate the prototyping paradigm.

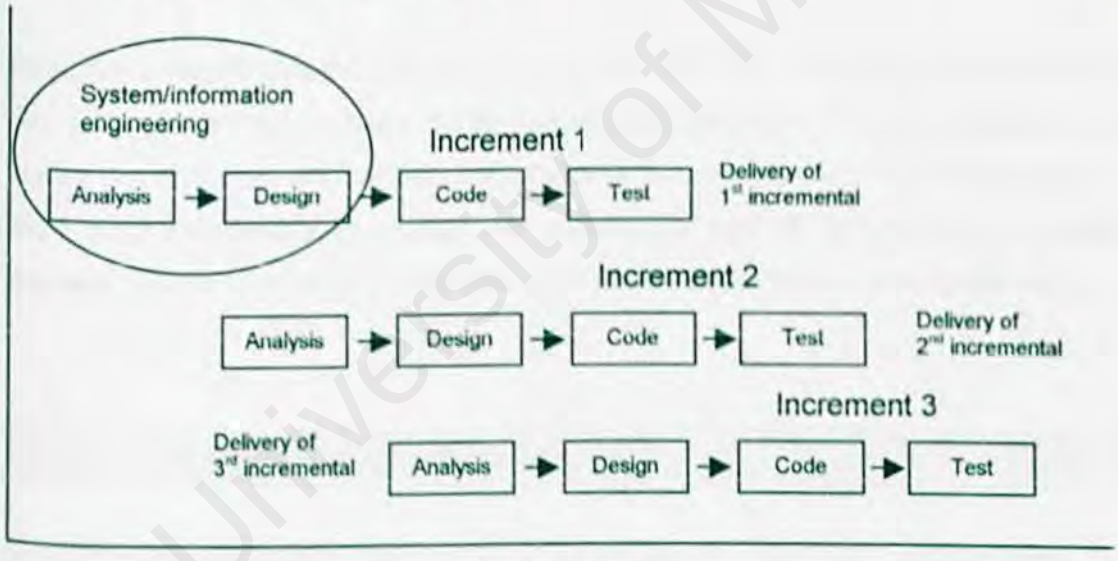

Figure 3.3 The Incremental Model

When an incremental model is used, the first increment is often a core product. That is, basic requirements are addressed, but many supplementary features (some known, others unknown) remain undelivered. The core product is used by the customer (or undergoes detailed review). As a result of use and/or evaluation, a plan is developed for the next increment. The plan addresses the modification of the core product to better meet the needs of the customer and the delivery of additional

features and functionality. This process is repeated following the delivery of each increment, until the complete product is produced.

The incremental process model, like prototyping and other evolutionary approaches, is iterative in nature. But unlike prototyping, the incremental model focuses on the delivery of a operational product with each increment. Early increments are "stripped down" versions of the final product, but they do provide capability that serves the user and also provide a platform for evaluation by the user.

Incremental development is particularly useful when staffing is unavailable for a complete implementation by the business deadline that has been established for the project. Early increments can be implemented with fewer people. If the core product is well received, then additional staff (if required) can be added to implement the

next increment. In addition, increments can be planned to manage technical risks. For example, a major system might require the availability of new hardware that is under development and whose delivery date is uncertain. It might be possible to plan early increments in a way that avoids the use of this hardware, thereby enabling partial functionality to be delivered to end users without inordinate delay.

3.4 Functional Requirement

Some of the functional requirements of the proposed system are listed below. The functional requirement can be divided into two: One is for the user and another is for the administrator:

3.4.1 Functional Requirement for User

a) Search

- The documents on education policy can be search by typing keyword, term, phrase into the search field then the search button is to be pressed to initiate the search process

b) Browse Record

- The policies information can be browse through using categorized topic such as act number, policy title, rules number and so on

c) View Record

- The users can only have the authority to read or view the document store in database

d) Feedback

- This module will enable the users to send feedback to the system regarding the suggestion, comments, and performance of the system. Thus enhancement can be done by reviewing the feedback

e) Attachment

- This will provides the users a module to submit documents for the administrator to review and put into the database for future usage.

f) Help

- This will guide the users to use or navigate the system more easily and give hints on how to get the relevant information

3.4.2 Functional Requirement for Administrator

a) Authentication section

- Only the administrator will be allowed to access this section by proving a password

b) Database Maintenance section

- This section will allow the administrator to maintain the login information and the information in the database

c) User Module Maintenance section
   - This section will only allow the administrator to update information about the proposed system

d) Feedback Maintenance section
   - This section will allow the administrator to receive the feedback and reply to the user

e) Attachment Maintenance section
   - This section will allow the administrator to view the attachment send by the users

3.5 Non-Functional Requirement

Following are some of the non-functional requirement of the system:

a) Reliability
   - Reliability is the extents to which a system can be expected to perform its intended function with required precision and accuracy. Thus, the system should be reliable in performing its daily functions and operations. For example, whenever a button is clicked, the system should be able to perform some functionality or generate some message to inform the user what is happening.

b) Scalability
   - The scalability is to promise the capability of the system to migrate as a client or server to machines of greater or lesser power, depending upon requirements, with little or no change to underlying components. Database scalability issues can be resolved using distributed database architecture whereas web application scaling can be addressed by increasing bandwidth or by additional web servers.

c) Usability

- The system should be developed in such as way that it is easy to use. It will enhance and support rather than limit or restrict the office processes. Human interfaces need to be intuitive and consistent with the ministry homepage and within itself.

d) Security

- The system should be equipped with sufficient security. Each access by the user should be authenticated and validated by the system. The system should not show any potential of leakage of information. The password should be encrypted.

e) Data and Services Backup

- The system should be able to restore to its normal operation from any potential disaster. There should be a second backup for data and services to ensure the continuous of operation.

f) Inter-Operability

- The system has the capability to work with different types of applications to share data and process. The system can be integrated with the web site hosted by the Ministry of Education by just inserting the path into the main web page of the ministry.

g) On-Time

- The system should be developed within the given time frame. In this period of time, all the requirement and also testing should be completed.

h) Manageability

- The modules within the system should be easy to manage. This will make the maintenance and enhancement works simpler and not times consuming.

i) Flexibility
   - The system should have the capability to take advantage of new technologies and resources. The system should be able to implemented in the changing environment.

3.6 System Analysis

System analysis is the study of a single information systems application. System analysis seeks a general understanding of the solution that would be required to solve the problem or exploit the opportunity identified in system investigation. It considers what existing system (if any) do to solve the problem, considers alternative solutions to the problem, and explores the feasibility and implications of these solutions. In short, systems analysis attempts to answer question "*What must the information system do to solve the problem?*" The primary deliverable from system analysis is a listing of system requirements and priorities. (Stair, 1995)

The objectives of this analysis phase are:

- To acquire knowledge on how does the proposed system works
- To survey how available system of this type had been developed and how does it working
  - To study how the new system will improve the current system
- Research on how this proposed system can be developed using current or maybe latest emerging technologies
  - Tools to develop the new system will be chosen among different types of new tools that have been studied and stated in chapter 2.
- To gain an overall understanding of the proposed system data flow and system process
- To identify the major components to be included in the proposed system
  - To identify what are the modules that are feasible to develop and the knowledge and tools need to have in order to develop them.
- To identify the software and hardware requirement to develop and reside the proposed system
- To analyze and plan control features to develop a robust and reliable system

3.6.1 Development Analysis

A review on development tools is carried out in order to identify the most suitable tools to develop this system. These tools include the entire platform, servers, development software and programming language. Besides considering the suitability of the tools to the requirement, the tools used must be able to support each other.

This review is divided into three parts. The first part focuses on the server and platform to host and store information of the system. The second part focuses on the tools use to develop the system. The third part discusses others concept that might be used for the development.

3.6.2 Servers and Platform

Observation and Informal interview with the system officers in Documentation Center, Education Planning and Policy Research Division, Ministry of Education, Malaysia the writer found out that the center is using Windows™ based environment. In the consideration for the entire platform, the Microsoft products are used as the main technology provider due to the fact that the proposed system might be integrated with the Documentation Center, Education Planning and Policy Research Division, Ministry of Education, Malaysia as the test bed of the proposed system. Following are the Microsoft products that used for the system:

a) Windows 2000 Server
   - It is used as main server operating system. The main reason is its user friendliness, stability feature and it provides the NT authentication and files system that can be used in the system's data repository components.

b) Internet Information Server 5.0 (IIS 5.0)

- IIS 5.0 is chosen as the web server mainly because it can be well supported by Windows 2000 Server operating system. IIS 5.0 can provide the basic web authentication for the web application that is used for the National Education Policy Information System.

c) Microsoft SQL Server 7.0

- It was chosen as systems database platform because it is stable and work well with other Microsoft components. It supports multi-user environment and it can handle more burden of database processing even in a distributed environment.

- The database can easily be mapped to the other processing server through Open Database Connectivity (ODBC 32bit)

d) Internet Explorer 5.0

- Internet Explorer version 5.0 is the most suitable browser for this system if compared to others. IE 5.0 is needed for this web-application system. It supports most of the HTML scripts and also the Active X DLL.

3.6.3 Development Software

Selecting the suitable software to develop the proposed system is important because it will simplify the work done by the programmer as well as reduced the time required to build the project. The following are the software that used to develop the system:

a) Visual Interdev 6.0

- Visual Interdev 6.0 becomes the editor for the ASP coding. It provides more features that are helpful for ASP coding. The graphical design can be drawn easily by using Visual Interdev 6.0.
- It also provides the script outline as well as the toolbox and server object that minimizes the burden to build a web-application.

b) Microsoft FrontPage 2000

- By using FrontPage 2000, web page can be created and designed easily with the tools provided by this software. It is also possible to include different kinds of web development technology in the web page such as JavaScript, VB Script, Java Applet, and so on.

c) Windows™ 98 Personal Web Server

- Besides using the IIS as the web server, the application could also be developed on a Windows™ 98 Personal Web Server (PWS). We could test and develop the ASP web pages by using the PWS in a client machine. It saves cost and time of development.

d) Adobe PhotoShop 5.0

- The Adobe PhotoShop 5.0 has been used to design the graphical picture that is needed for the system. Using the Adobe PhotoShop 5.0, we can easily manipulate pictures with different effects and quality to be use in the web environment.

3.6.4 Others Concept Used

a) Search Engine

The software that searches an index and returns matches. Search engine is often used synonymously with spider and index, although these are separate components that work with the engine. Spider is another software that gather all the related document that matches a given query.

A similar concept will be used in developing the proposed system, whereby a search will be done at the back end database and return the relevant results to the users.

b) Structure Query Language (SQL)

SQL string/statement is an expression that defines an SQL command, such as SELECT, UPDATE, or DELETE, and includes clauses such as WHERE and ORDER BY. SQL strings/statements are typically used in queries and in aggregate functions.

SQL was the basic database query language that is used for the system. It is simple to use and most importantly, it is well supported by the SQL server and other Microsoft Technologies.

3.7 Development Requirement

To summarize, this project will require the following tools and technologies:

a) Hardware Requirements

Development of this system, requires a machine with:

- Pentium II 300Mhz and above or AMD K6-2 300Mhz (3D NOW) and above
- 128 MB RAM and above
- 100 MB Free Hard disk space and above
- Keyboard, mouse and monitor

Development of this system, requires a server with:

- Pentium III 500Mhz and above or AMD Athlon K7 500Mhz and above
- 256 MB RAM and above
- 1GB Free Hard disk space and above
- Keyboard, mouse and monitor

b) Microsoft Products

- Microsoft Windows 2000 Server as the platform
- Internet Information Server 5.0 as the web server
- Microsoft SQL Server 7.0 as the database server
- Internet Explorer 5.0 as the browser

c) Development Software
   - Visual Interdev 6.0
   - Microsoft FrontPage 2000
   - Windows 98 Personal Web Server (PWS)
   - Adobe PhotoShop 5.0

d) Programming Language
   - Active Server Pages (ASP)
   - Active X DLL and Components
   - Hypertext Markup Language (HTML)
   - VB Script
   - Jscript

e) Others Concept Used
   - Search Engine
   - Structure Query Language (SQL)

3.8 Summary

The topic of system requirement and analysis begins with the information gathering techniques such as readings, observation, interviewing and Internet research. Then, the writer elaborates the system development strategy that described the waterfall prototype, and incremental methodology. Subsequently, the functional and non-functional requirements are both important elements in analyzing system needs. In addition, the analysis of development tools, programming language and concept used are included. Hardware and software requirements are discussed as well. Chapter 4 will discuss about systems design.

CHAPTER 4: System Design

4.1 Introduction

A design specification describes the features of the system, the components or elements of the system and their appearance to user. (Senn, 1989) The purpose of the system design is to select and plan system that meets the requirements needed to deliver the problem solution. System design results in a new or modified system, and thus results in change.

4.1.1 Logical and Physical Design

The NEPIS system is designed along two dimensions: logical and physical.

4.1.1.1 Logical Design

The logical design describes the functional requirements or purpose of NEPIS system. Its specifications that are determined and documented included:

- *Output design*
  Output design describes all output from the systems and includes the types, format, content, and frequency of outputs.

- *Input design*
  Once output design has been completed, input design can begin.

- *Processing design*
  The types of calculations, comparisons, and general data manipulations required of the system are determined during processing design. For example, an NEPIS system will require searching the related documents in database.

- *Files and database design*
  NEPIS system requires the use of files and database systems.

- *Procedure design*
  All systems require procedures to run applications and handle problems if they occur. Once designed, procedures can be described by using text and word processing programs.

- *Controls and security design*
  Another important part of logical design is to determine the required frequency and characteristics of backup systems.

4.1.1.2 Physical Design

The physical design specifies the characteristics of the system components necessary to put the logical design into action. The physical design must specify the characteristics of each of the important system components below:

- *Hardware design*
  All computer equipment, including input, processing, and output devices, must be specified by performance characteristics.

- Software *design*
  All software must be specified by capabilities.

- *Database design*
  The type, structure, and function of one or more databases must be specified. The relationships between data elements established in the logical design must be mirrored in the physical design as well.

- *Telecommunication design*
  The necessary characteristics of the communications software, media, and devices must be specified.

- *Procedures and control design*
  How each application is to be run, as well as what is to be done to minimize the potential for crime and fraud must be specified. These specifications include auditing, backup, and output distribution methods.

The system design for NEPIS is divided into the following stages:

- System Functionality Design
- Network Design
- Database Design
- Graphical User Interface Design

4.2 System Functionality Design

Under the system functionality design, the focus will be on the architectural design, data flow diagram and system structure chart for the NEPIS.

4.2.1 Architectural Design

In developing the proposed system, the client/server architecture is used because in this type of application, the client would never access the data storage system directly. Besides, it allows for any part of the system to be modified without having to change the others two parts. The system can operate at its highest efficiency, no matter what the load on the system.

4.2.1.1 Three-Tier Client/Server Architecture

In the NEPIS, the frontier that is the application tier consists of all the necessary applications. In this layer, the main application component that appears to the user is the Internet Explorer 5.0 browser. This layer will provide the user interface. HTML, VB Script and Active X control are used to activate the application layer All of them provide the most flexible and dynamic interface for the users. The application is always reside within the web server, which is the Internet Information Server 4.0.

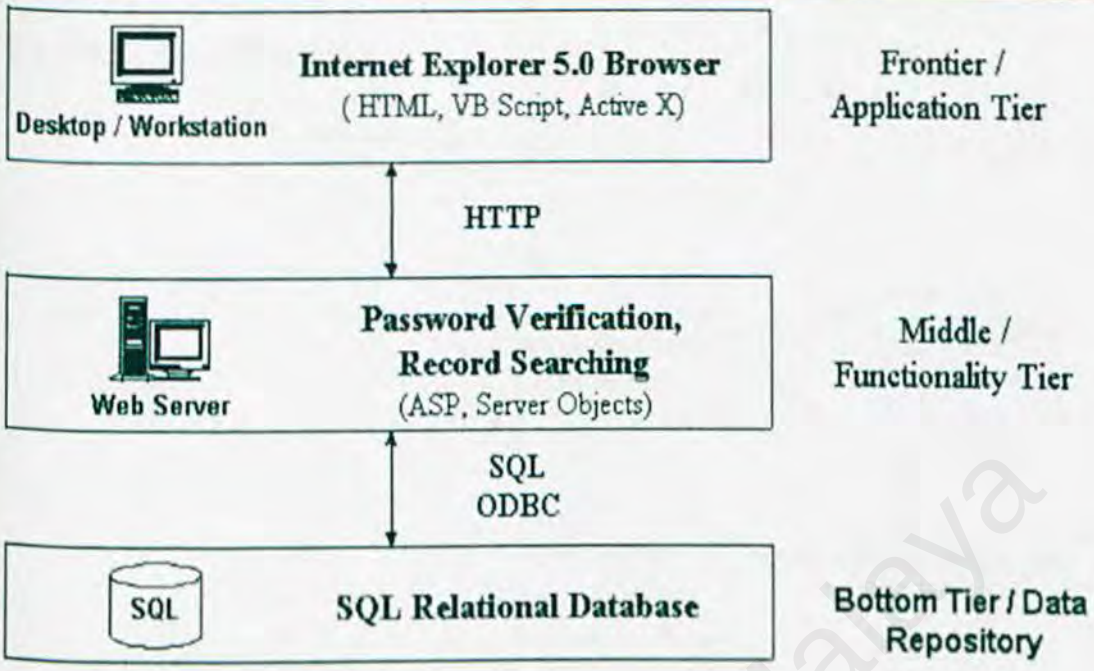

Figure 4.1 NEPIS Three-Tier Client/Server Architecture

The middle tier is known as the functionality or service tier. The communications between this tier and the frontier depends on the Hypertext Transfer Protocol (HTTP) for the web pages transfer. The functionality tier consists of the components that are created to support the NEPIS such as password verification, searching for record and other configuration. All these components require Active Server Pages and the ASP server objects to perform the functions in the web servers. The IIS in this tier will processes the request from the client and produces the result in web pages format. The IIS will also processes any data request of the user by linking to the database server, which contain in the bottom tier. The IIS will do other extra additional activity during the data processing

The bottom tier is the data repository for NEPIS. The data repository is built up by the SQL database. It functions as the main database for the system. The components in the middle tier are connected with the SQL database in the bottom tier through the combination of the Structured Query Language (SQL) and Open Database Connectivity (ODBC).

4.2.2 Data Flow Diagram

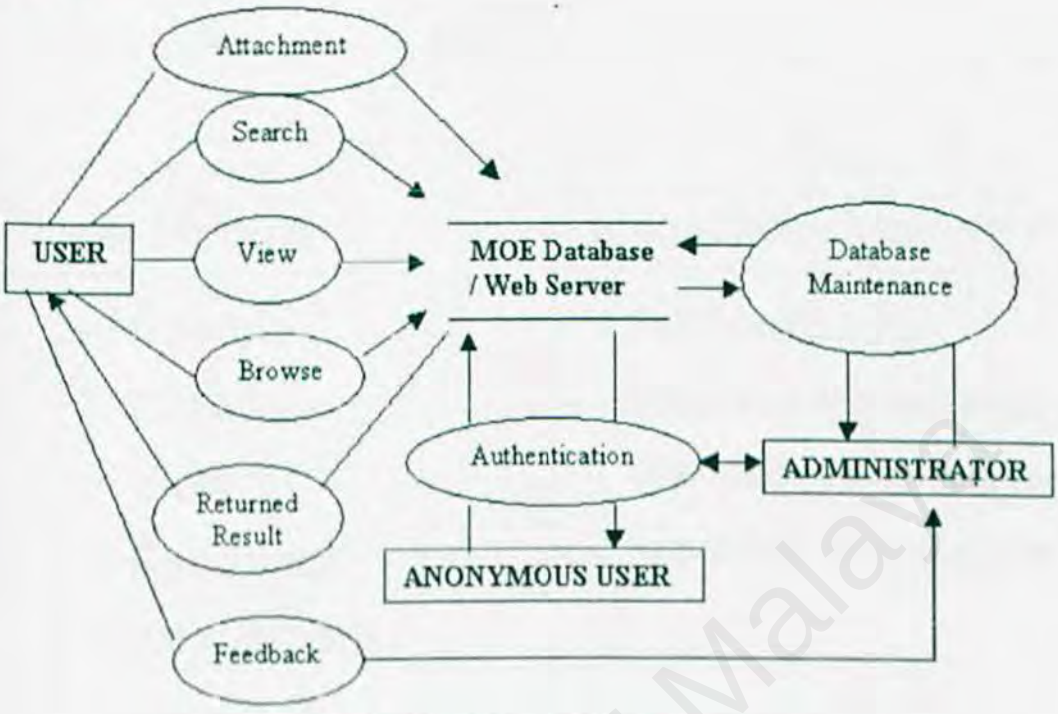

Figure 4.2 NEPIS Data Flow Diagram

According to Figure 4.2 the NEPIS data flow diagram, the user can search, view and browse for a certain documents related National Education Policy. The database will be searched to match the user query. Then, all relevance documents will be presented to the user. After using the proposed system, the user can send any comments and suggestions to the administrator using the feedback module.

The administrator has the rights to add, delete modify the records in the database. After a pre-defined period, the administrator will backup the database for data recovery purpose if any disaster strikes. In order to maintain data integrity in the database, the administrator has to set rights for accessing the database which include read, write and edit. After receiving feedback from the user, the administrator can use it as a guideline to further enhance the proposed system

4.2.3 System Structure Chart

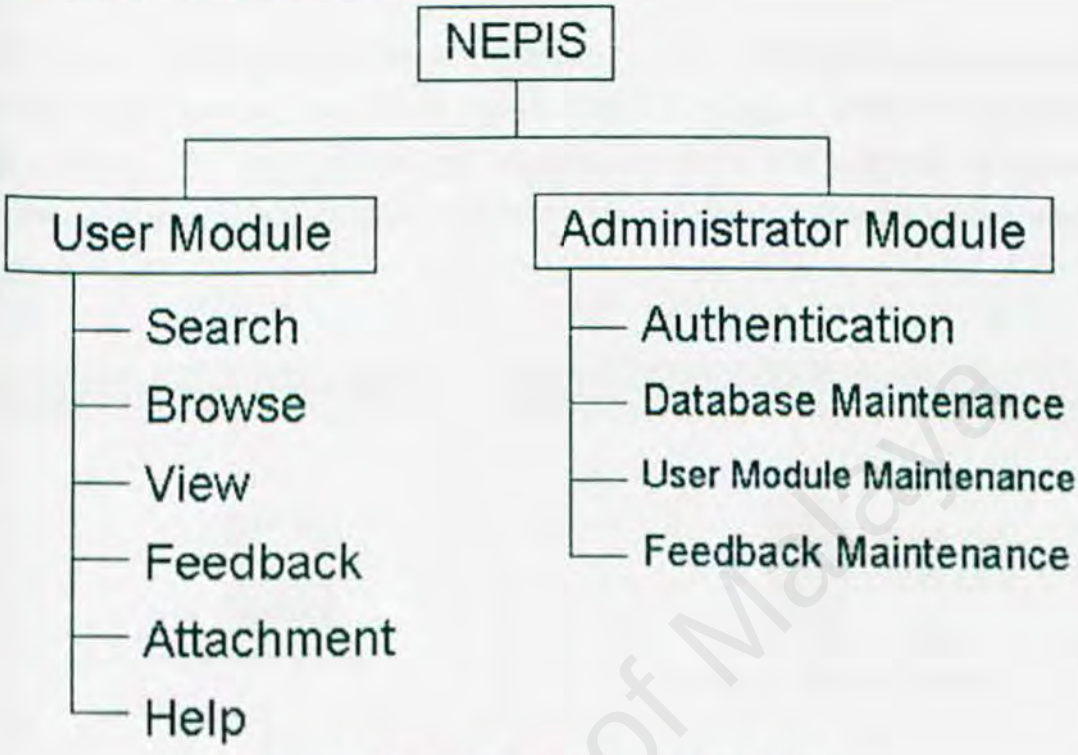

Figure 4.3 NEPIS System Structure Chart

NEPIS is divided into two main modules, which are the administrator module and the user module. Each of the modules will perform specific functionality based on the need of the users (both administrator and users). Each of these modules is further divided into sub-modules as shown in the figure 4.3.

4.2.3.1 User Module

This module is developed to provide much functionality to the user. The user can search, view and browse for the documents he or she required from the proposed system. They can even send comments and suggestions to the administrator about the proposed system. If the user does not know how to navigate through the proposed system, he or she can use the help module provided in the system.

4.2.3.2 Administrator Module

This module is designed for the administrator. The administrator can assign new administrator users with user name and password to modify or delete records from the database. The administrator can read the comments and suggestions posted by the users to evaluate the system performance and thus improve the weaknesses of the system.

4.3 Network Design

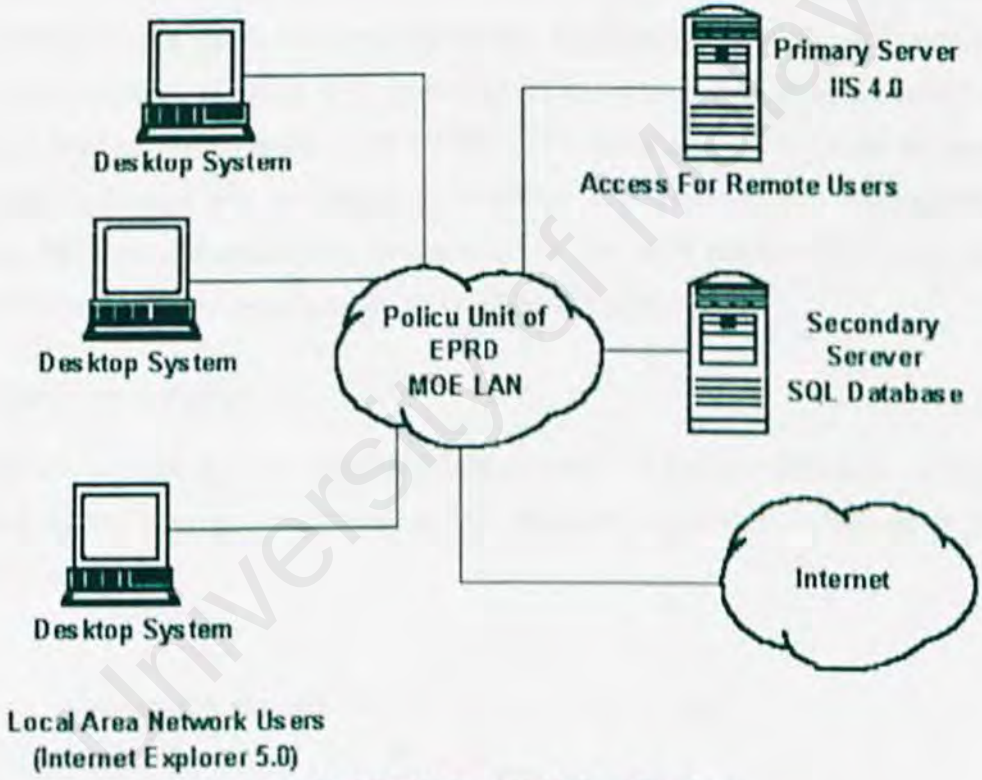

Figure 4.4 NEPIS Network Setup Design

The design of the network setup is important. The NEPIS allows local area network users to access the information in the proposed system. The remote users are able to access the proposed system through the Internet. The connection between the user desktop and the web server is linked with the Internet facilities. The entire connection is communicated with TCP/IP protocol.

From figure 4.4, there are two servers that become the primary server and the secondary server. The primary server will contain Internet Information Server whereas the secondary server will contain the SQL server. Under the this network design, the system administrator should be aware of the security of the primary server that can be accessed by users through the Internet.

4.4 Database Design

Databases and database technology are having a major impact on the growing use of computers. It is fair to say that database will play a critical role in almost all areas where computers are used, including business, engineering, and etc. A Database Management System (DBMS) is a collection of programs that enables users to create and maintain a database. The DBMS is hence a general-purpose software system that facilitates the processes of defining, constructing, and manipulating databases for various applications. In this section, the entity relationship model and the data dictionary of the proposed system will be discussed.

4.4.1 Database Structure

The proposed system is using Microsoft SQL Server 7.0 as the database platform. Figure 4.5 is the figure that illustrates the mapping of the SQL Server to the

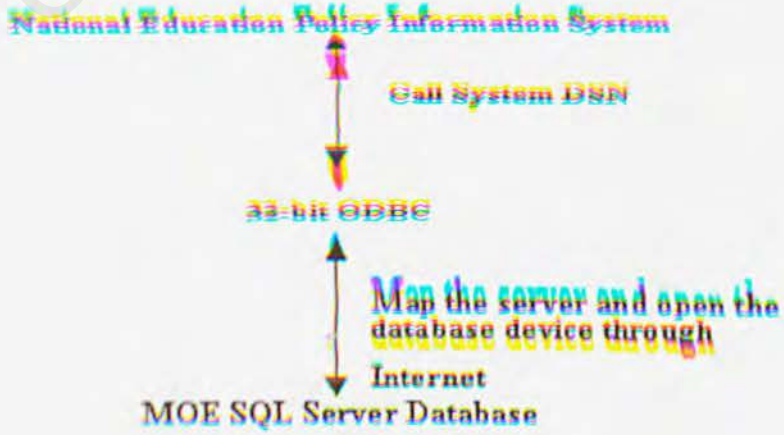

Figure 4.5 The Mapping of Database to Application

4.4.2 Entity Relationship Model

Entity-Relation (ER) model is a popular high-level conceptual data model. This model and its variations are frequently used for the conceptual design of database application, and many database design tools employ its concepts. The ER model describes data as entities, relationships, and attributes.

Symbol	Meaning
	ENTITY TYPE
	WEAK ENTITY TYPE
	RELATIONSHIP TYPE
	IDENTIFYING RELATIONSHIP TYPE
	ATTRIBUTE

Table 4.1 Summary ER Diagram Notation

Before the reader is presented with the ER diagram, it is appropriate understand the meaning of each symbol representation inside the ER diagram. The meaning of each symbol is shown in table 4.1.

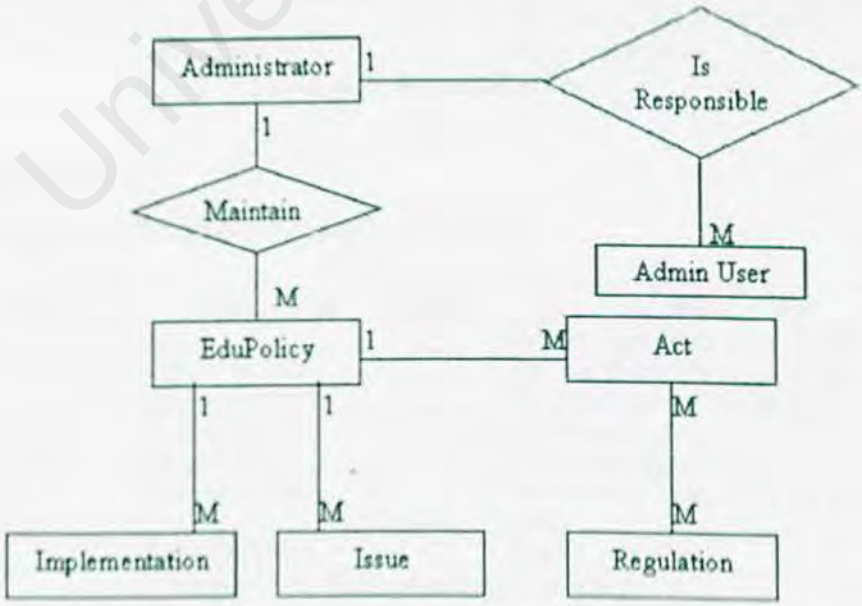

Figure 4.6 NEPIS Database ER Diagram

From the ER diagram shown in figure 4.6, the Administrator is responsible to authorize Admin User and maintain the EducationPolicy. The relationship between EducationPolicy and Section is one to many while Section has a many to many relationship with Regulation. On the other hand, EduactionPolicy has a one to many relationship with PolicyArticle and also a one to many relationship with Implementation.

4.4.3 Data Dictionary

The data dictionary explains the items and fields of the database that used in the National Education Policy Information System. The database is named **NEPD** to represent National Education Policy Database.

* Represent the **primary key**

Name: Admin

Description: Login name for the administrator.

Field Name	Data Type	Null	Description
*ID	Int		Auto Number ID for each record
Username	Nvarchar (8)		The administrator login username
Password	Nvarchar (8)		The administrator login password
AdminName	Nvarchar (50)		The administrator actual name
Position	Nvarchar (50)		The administrator position in the department
Department	Nvarchar (50)		The department of the administrator
Remarks	Nvarchar (255)	√	Remarks for the administrator
EntryDate	SmallDateTime		Record entry date

Table 4.2: Admin Table

Name: EduPolicy

Description: National Education Policy for Malaysia.

Field Name	Data Type	Null	Description
*ID	Int		Auto Number ID for each record
Title	Nvarchar (100)		The title of the education policy
Description	Nvarchar (255)		The description of the education policy
Location	Nvarchar (255)		The location of the education policy
Language	Nvarchar (10)		The language of the education policy
Keyword	Nvarchar (500)		The keyword indexed for the education policy
EntryDate	SmallDateTime		Record entry date

Table 4.3: EducationPolicy Table

Name: Act

Description: Parts in the Education Act.

Field Name	Data Type	Null	Description
*ID	Int		Auto Number ID for each record
PartNo	Int		The part no in the education act
Title	Nvarchar (100)		The title of the part
Description	Nvarchar (255)		The description of the part
Location	Nvarchar (255)		The location of the part
Language	Nvarchar (10)		The language of the part
Keyword	Nvarchar (500)		Keyword indexed for the part
EntryDate	SmallDateTime		Record entry date

Table 4.4: Act Table

Name: Regulation

Description: Regulation in education act.

Field Name	Data Type	Null	Description
*ID	Int		Auto Number ID for each record
Title	Nvarchar (100)		The title of the regulation
Description	Nvarchar (255)		The description of the regulation
Location	Nvarchar (255)		The location of the regulation
Made	SmallDateTime		The date when the regulation was made
Language	Nvarchar (10)		The language of the regulation
Keyword	Nvarchar (500)		Keyword indexed for the regulation
EntryDate	SmallDateTime		Record entry date

Table 4.5: Regulation Table

Name: Implementation

Description: Implementation of the policy.

Field Name	Data Type	Null	Description
*ID	Int		Auto Number ID for each record
Year	Nvarchar (11)		The implementation year of a education strategy
Title	Nvarchar (100)		The title of the implementation
Description	Nvarchar (255)		The description of the implementation
Location	Nvarchar (255)		The location of the implementation
ByWho	Nvarchar (50)		The implementation was done by who
Department	Nvarchar (50)		The department of the implementer
Source	Nvarchar (50)		The source for the of the implementation document
SourceTitle	Nvarchar (50)		The source title for the of the implementation document
Publisher	Nvarchar (50)		The publisher for the of the implementation document
YearPrint	Nvarchar (4)		The printed year for the of the implementation document
Page	Nvarchar (10)		The page for the implementation document
Language	Nvarchar (10)		The language for the implementation document
Keyword	Nvarchar (500)		Keyword indexed for the implementation document
EntryDate	SmallDateTime		Record entry date

Table 4.6: Implementation Table

Name: Issue

Description: Issue that are related to education policy.

Field Name	Data Type	Null	Description
*ID	Int		Auto Number ID for each record
Isu	Nvarchar (50)		The discussed issue
Title	Nvarchar (100)		The title of the issue
Description	Nvarchar (255)		The description of the issue
Location	Nvarchar (255)		The location of the issue
Source	Nvarchar (50)		The source of the issue
SourceTitle	Nvarchar (50)		The source title of the issue
Publisher	Nvarchar (50)		The publisher of the source
Year	Nvarchar (4)		The printed year of the source
Page	Nvarchar (10)		The page of the source
Language	Nvarchar (10)		The language of the issue
Keyword	Nvarchar (500)		Keyword indexed for the issue
EntryDate	SmallDateTime		Record entry date

Table 4.7: Issue Table

Name: AllTable

Description: All the document tables in the database.

Field Name	Data Type	Null	Description
*ID	Int		Auto Number ID for each record
TableName	Nvarchar (50)		The table name

Table 4.8: AllTable Table

Name: Feedback

Description: All the feedback from the users.

Field Name	Data Type	Null	Description
*ID	Int		Auto Number ID for each record
Feedback	Nvarchar (500)		The feedback send by the users
EntryDate	SmalDateTime		Record entry date

Table 4.9: Feedback Table

Name: Upload

Description: All the uploaded files from the users.

Field Name	Data Type	Null	Description
*ID	Int		Auto Number ID for each record
SendBy	Nvarchar (50)		E-mail of the sender
Source	Nvarchar (100)		The source of the attachment
Location	Nvarchar (255)		The location of the uploaded file
EntryDate	SmallDateTime		Record entry date

Table 4.10: Upload Table

4.5 Graphical User Interface Design

The user interface of the proposed is designed to improve the efficiency and effectiveness of the user when using the entire system. Thus, the interface design for the NEPIS is easy to understand and easy to use. The users do not have to type any commands and what he or she needs to do is just some mouse clicks. NEPIS user interface is created as friendly as possible. This design is able to prevent failures and improper procedures.

4.5.1 Design of Screen

In the designing of the graphical user interface for NEPIS, the writer will use a template graphical user interface to develop the proposed system. This will enable the graphical user interface of the proposed system can be enhanced over the

development process based on feedback receive by the writer. The template graphical user interface is divided into two frames. From figure 4.7, the reader can notice that the left frame contains the menu control while the right frame contains the task or the function display for the selected control.

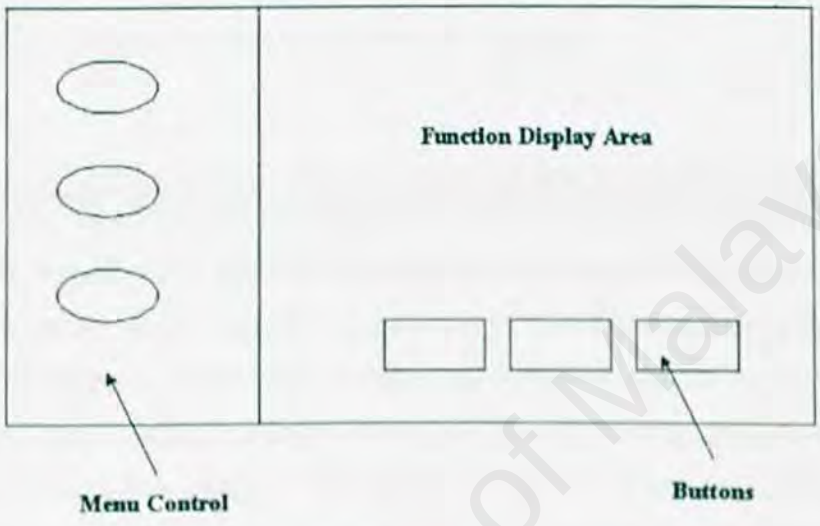

Figure 4.7 NEPIS Template Interface Design

The design of the graphical user interface for NEPIS is divided into the administrator screen and the user screen. The difference between the administrator screen and the user screen is the functionality provided by the control menu and thus controlling the task that can be done the administrator and the user.

4.6 Project Expectation

Basically, for any project, certain expectations of the outcome are projected before the work started. A few factors have to be considered in making these expectations. One of the important factors is the amount of time available to complete the project and also the technologies and resources available. The following are some of the expectations of the project:

- System can perform some basic function such as search, browse, view capabilities and meet some criteria such as stable, consistency, user friendly and also reliability.

- The systems will be able to fulfill the requirement of information retrieval and can perform the required functions efficiently and effectively
- The proposed system is quite a complete solution. However, it needs to be enhanced so that more functionality can be added.
- The final implementation should allow for future enhancement as well as additional module to add functionality to the National Education Policy Information System that suit to the need of the users.

4.7 Summary

This chapter begins with a general overview about system design that can help the developer to design a good system or application. Then, the reader is introduced to the proposed system functionality design that includes system architecture, data flow diagram and system structure. Network design of the proposed system is briefly discussed in this chapter. After that, the reader attention is brought to the database design of the proposed system and the usage of template graphical user interface in designing the interface for the proposed system. Finally, the expected outcome of the project undertake is stated.

CHAPTER 5: System Implementation

5.1 Introduction

After system design phase, the design model of the National Education Policy Information System will be transformed into a workable solution. In order to implement this system, two major tasks have to be completed before any testing can be done on the system. The tasks are platform development and modules implementation or coding.

5.2 Platform Development

In platform development, all the configuration and setting up the necessary system development environment will be done. This includes setting up Windows 2000 Server, SQL Server 7.0 and configures the Internet Information Server (IIS).

5.2.1 Setting Up Windows 2000 Server

For the system to be fully functional, it needs to be hosted in a Windows based server environment. Therefore, setting up Windows 2000 Server is a must. After several planning and preparation, the setting up process finally begins. Compare Windows 2000 Server and Windows NT 4.0 Server, the later one requires more time to configure due the fact that several service pack has to be installed before Internet Information Server (IIS) and SQL Server are fully functional.

Setting up Windows 2000 Server was much more easier because the operating system setup application provides a user-friendly walkthrough menu to guide the installation process. During the installation process, certain administration tools can be left behind without properly configure because of thee flexibility provided by Windows 2000 Server.

In the setting up the server, the writer has chosen to format the hard disk using NTFS 5.0 file system (comes with Windows 2000 Server) to ensure a more stable and secured transaction across platform. After that, the network environment is properly configured.

The name TCT is assigned as the server name. Finally, for added security the Windows 2000 Server Service Pack 1 is downloaded from Microsoft's Windows Update web site (http://windowsupdate.microsoft.com/).

5.2.2 Setting Up Microsoft SQL Server 7.0

The database management application, Microsoft SQL Server 7.0 is installed in the TCT server. After the Microsoft SQL server has been installed successfully, a new database is created giving it the name **NEPD** (National Education Policy Database). Then, tables are created according to the database design. NEPD will store all the data require by the system.

Due the fact that the system is an information intensive system, so the database itself should not be empty. Therefore, data should be imported from development database (Microsoft Access 2000) where existing data in the database can be feed into the new database. Using an importing data module in SQL Server 7.0 able to do this task. First, the development database must be select as a source database and the NEPD database as the destination database.

Furthermore, the SQL Server 7.0 is configured to backup the NEPD database on a fortnight basis in case of any disaster strikes even the database is not updated on a daily basis. Enough hard disk space is allocated for the database to maximize the performance of the SQL Server 7.0 and to ensure there is enough space to store the records. The file growth of the database is set to 10% of the original database size.

In order to map the database to the web server, a system Data Source Name (DSN) is used. The system DSN named **NEPD** was registered through the ODBC in the web server machine. The ODBC could map to the database storage even it is in the different machines. Likewise, the web server could open the database storage by just calling the system DSN.

5.2.3 Configure Internet Information Server

The default installation for Windows 2000 Server does not include Internet Information Services; therefore in configuring the Internet Information Server (IIS) the Internet Information Services must be installed. This done by clicking the Add/Remove Programs icon in the Control Panel, then the Internet Information Services component can be selected and installation process will be initialized.

After installing the IIS, it can support Active Server Page (ASP) application development environment. Under this environment, Hypertext Markup Language (HTML) code, scripting languages, ActiveX components can be combined to create powerful web application.

5.3 Modules Implementation

The developed system consists of two main modules that are the user module and administrator module. Both of the modules are developed using Active Server Page (ASP) programming language. This is because ASP works well Internet Explorer 5.0 (IE 5) and Internet Information Server 5.0 (IIS 5.0).

5.3.1 User Module

In the user module, the users can use it to perform several functions. By using the user module, the users can view the background information on National Education Policy and the objective of the system. Besides that, the users can type their search criteria to search to meet their information needs. After using the system, the users can send feedback to the administrator regarding the system. The users can even

share information with the administrator by uploading document for the administrator to review the uploaded document.

If one observes the system carefully, he/she will know that majority of the functions provided require database connectivity. Functions like searching document, browsing document, sending feedback and file attachment must connect to the database in order to perform the intended task. So, the writer will like to discuss the programming code for database connection.

```
<% 'This tell the browse where the ASP code starts
dim cnn, rst
Set cnn = CreateObject("ADODB.Connection")  'create the database connection
object
cnn.Open "DSN=NEPD","sa"  'open the database connection
Set rst = Createobject("ADODB.Recordset")  'create the record set object
rst.ActiveConnection = cnn                 'parameters use by the record set
rst.CursorType = adOpenKeyset              'to manipulate the data
rst.LockType = 2
rst.open "Seect * from Admin"              'open the record set

'perform certain task

'After perform certain task the database connection and record set should be close
to 'release it from the memory
rst.close
Set rst = Nothing
Cnn.close
Set cnn = Nothing
%>
```

5.3.1.1 Program Flow for Each of the Functions

- **Searching Documents**

1. The users type in their search criteria and the search criteria is sent to the server.
2. The server script analyzes the search criteria and performs a search in the database.
3. If there is no matching result then the server script will tell the client browser not matching data was found.
4. If there are documents that match the search criteria then the server script will return the results to the client browser.
5. Then the users can pick the document and view it.

- **Browsing Documents**

1. The users must first select a topic according to their taste.
2. Then, they must select an area in the related to the topic.
3. After the area is selected then the users can request to view the document.
4. The interested document is presented to the users.

- **Sending Feedback**

1. The users are required to type in their feedback in the feedback column.
2. Or the users can send the feedback using the administrator email.
3. By sending the feedback, the users will be acknowledged that their feedbacks have been submitted.

- **File Attachment**

1. The users have to fill in the required fields to start uploading their documents.
2. Then, the users must select the file from their computer.
3. Finally, they can send the document to the administrator.
4. After receiving the users' document, the system will acknowledge the users.

During the development of the user module, some error checking was performed in the coding part to ensure the system function properly. For example, no duplicate data can exist in the database, prompt users to fill in the required data, acknowledge the users after certain task was performed. However, all the error checking task was perform without letting the users know it.

5.3.2 Administrator Module

The administrator module was developed for the purpose of controlling the system to ensure it functions properly. In the administrator module, the administrator can perform various tasks just by clicking the mouse. The administrator can assign new administrator to use the administrator module. Besides that, the administrator can manage the documents in the database, view the feedbacks send by the users and view the files submitted by the users.

In order to ensure the administrator to perform he/hers task in a security environment, every administrator page is assigned a session variable generate by the server script. If some unauthorized users try to access the administrator web site, they will be redirected to the administrator login page. Here is some programming codes related to the session variable.

```
<%
    dim cnn,
    set cnn = server.createobject("ADODB.Connection")
    cnn.open "DSN=NEPD", "sa"
    'check for the valid username to generate session variable
    if session("blnValidUser") = true and session("AdminID") = "" then
        dim rsUserCheck
        set rsUserCheck =  server.createobject("ADODB.Recordset")
        dim strSQL
        strSQL = "SELECT ID FROM Admin " & _
                 "WHERE username = '" & session("username") & "'"

        rsUserCheck.open strSQL, cnn

        if rsUserCheck.EOF then
          'not valid user set session variable to false
          session("blnValidUser") = false
        else
          session("AdminID") =  rsUserCheck("Id")
        end if
        rsUserCheck.close
        set rsUserCheck = nothing
    end if
%>
```

5.3.2.1 Program Flow for Each Function

- **New Administrator**

1. The administrator has to decide whether to add, delete, modify and view the data in the database.
2. Then, he/she can click the appropriate button to perform the intended task.
3. The administrator will receive a message after the intended task is performed.

- **Document Management**

1. In this module, the administrator has a choice either to view all the documents in a table or search for certain documents by typing the search criteria.
2. Then, the results will be displayed in a tabular format.
3. The administrator can click the link to the document and view it.
4. Or the administrator can click the edit link to edit a specific document.
5. If the administrator intended to add a document, then the administrator can select a table and click the add button in the page.

- **View Feedback**

1. If there is no feedback in the database the administrator will be informed that there is no feedback in the database.
2. The administrator can view the feedback by selecting the feedback number.
3. After finish reading the feedback the administrator has a choice either to delete the feedback or view another feedback.

- **View File Attachment**

1. If there is file uploaded in the database, the administrator can view the file by clicking the link to the file.
2. If there is no uploaded file, the administrator will be informed.
3. After opening the uploaded file, the administrator can delete the file's information from the database and a message will be shown.
4. But, the administrator has to manually remove the file in the server's hard drive.

5.4 Coding Approach

Using an "architectural approach" which consists of three different layers which is the user interface layer, data layer and transaction layer develops NEPIS system. A layered paradigm has many benefits that help meet objectives in application development. The following is the short list:

- Maintainability. Codes are organized well. Task-oriented codes are centrally located.
- Reusability. Task-oriented codes are easily developed for reuse, especially for tasks that cross application boundaries.
- Simplicity. Modular design removes the use of "spaghetti code" and fosters elegance, not "hacks".
- Testability. Modules can be tested easily. Modularization breaks up the code coverage task into smaller and manageable units.
- Speed. Module code can safely be optimized without affecting the calling procedures.

5.5 Process Integration

Any Internet user can access the NEPIS system, which resides in Windows 2000 Server, using Internet Explorer as the web browser. The web page serves as an interface between the user and system. When the user sends a request to the system, the system will response and completes the operation in the server before sending back the information to the client browser. For instance, when a user enters his/hers search criteria and send it to the server. The server will process it and return the search results to the user using the web browser. The request and response proves is illustrated in figure 5.1

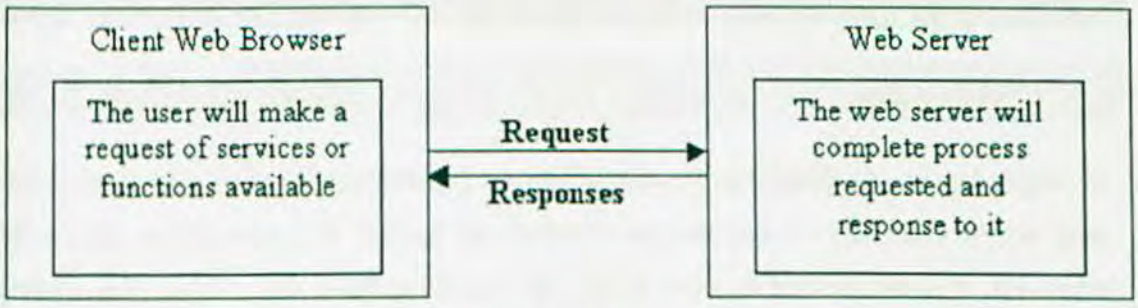

Figure 5.1 The Request and Response Process

5.6 Summary

From this chapter, the reader will be able to understand how the system is implemented. First, the reader will be able to read about the platform development and module implementation. In the module implementation, the writer discusses how the user module and the administrator module are implemented. Then, coding approach used in the developing the system is explained. Finally, the process integration is mentioned.

CHAPTER 6: Testing

6.1 Introduction

After the coding or implementation process is done, the testing phase will begin. In this stage, many types of testing are done to ensure the end product or the final system will perform as what it should be. Many type of testing have to be done before the system is released to the customer to ensure that the system is developed according to its specification and every function implemented in a program works correctly. (Pfleeger, 1998)

Testing is not the first place where faultfinding occurs; but testing is focused on finding faults, and there are many ways to make the testing efforts more efficient and effective.

6.2 Defect Testing

There are two approaches to defect testing:

- Structural or white-box testing where the tests are derived from knowledge of the program's structure and implementation.
- Functional or black-box testing where the tests are derived from the program specification.

6.2.1 White-Box Testing

White box testing involves the structure of the code directly (Pressman, 2001). This testing was carried out at the early stages of the testing process to ensure that the internal operations of the system perform according to specification.

White-box testing ensured that:

- All independent paths within a module have been exercised at least once.
- All logical decisions are executed on both their true and false sides.

- All loops are executed at their boundaries, and within their operational bounds
- All internal data structures are exercised to ensure their validity.

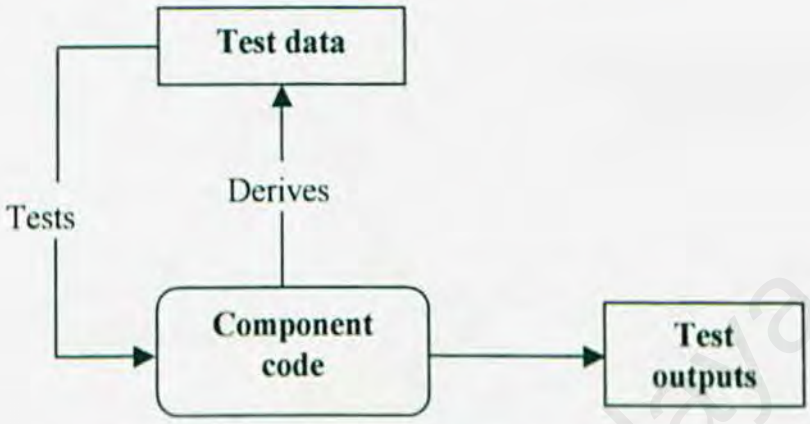

Figure 6.1: White-Box Testing

6.2.2 Black-Box Testing

Black box testing assumes that the logic structure of the code is unknown. It is a "black box". This is the point at which the function of a module is tested (Pressman, 2001). This testing was used during the later stages of the testing process.

Black box testing is not an alternative to white box testing. It is a complementary approach that can uncover a different class of errors from those uncovered by using white box testing.

Black box testing has found

- Missing, or incorrect functions
- Interface errors
- Errors in data structures, or external database access
- Performance errors
- Initialization and termination errors

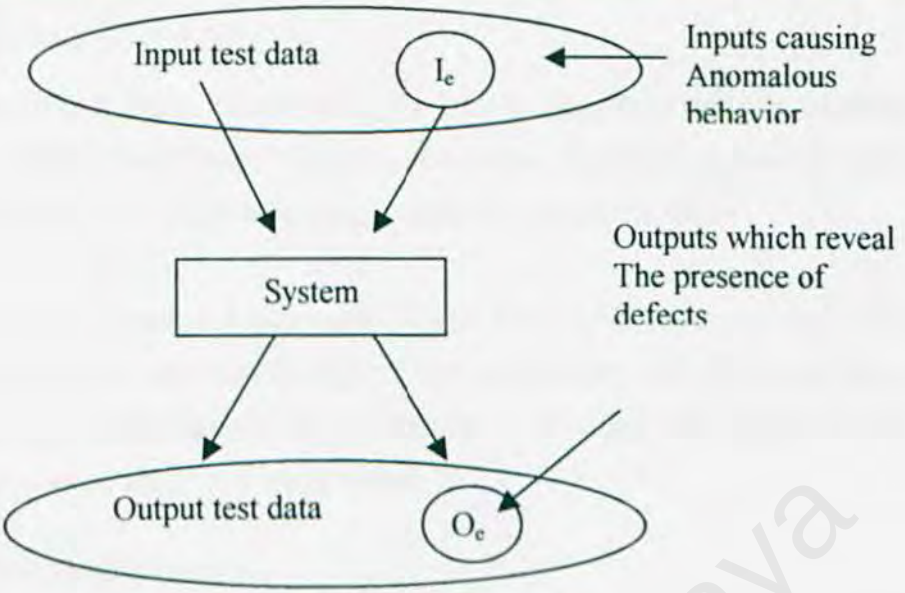

Figure 6.2: Black-Box Testing

6.3 Testing Strategies

Testing conducted include unit testing, module testing, sub-system testing, and system testing. Refer to Figure 6.1 for the testing process.

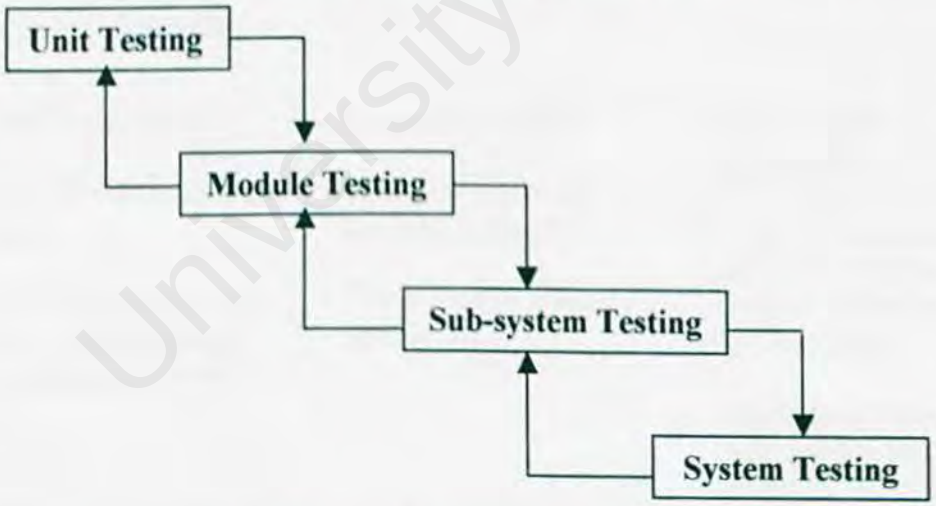

Figure 6.3 Testing process

Bottom-up testing strategy was used where testing starts with the fundamental components, and later works up the hierarchy of modules until the final module is tested (Pressman, 2001). Before performing any of the testing, test data have to be loaded into the database.

6.3.1 Unit Testing

Unit testing tests individual components, to ensure that they operate correctly. These components include functions and subroutines. Each component is tested independently, without other system components (Pressman, 2001).

In the development of National Education Policy Information System, unit testing was done after the development of each of the component and not at the end of development of the whole system. There were too many unit test cases involved. Therefore, only one will be shown as example.

6.3.1.1 Unit Test Case Example

The new user function under the administrator module in the application provides the ability to insert, edit and deleted administrator information. Unit testing was carried out on each function once it was completed. If it was tested to be functioning correctly, development of the next function was carried out. Else, debugging was carried out to identify the error before having it tested again. Table 6.1 shows the partial test cases for unit testing on the function of adding a new administrator record into the database.

No	Test Procedure	Expected Output	Test Result Analyzing
1	Click the Administrator link.	The new administrator page is displayed.	The new administrator page is displayed at the parent frame.
2	Fill in data in the new administrator page. Click the Add button.	The record is inserted permanently.	Record is inserted successfully. Objective of inserting a new administrator record is achieved.

Table 6.1 Partial Test Cases for Adding New Administrator Record

6.3.2 Module Testing

A module is a collection of dependent components. A module encapsulates these related components. Module testing enables each module to be tested independently without other system modules (Pressman, 2001).

6.3.2.1 Module Test Case Example

After the new administrator module was completed, module testing was carried out to ensure the module functioning as expected. Table 6.2 shows the partial test case for new administrator module.

No	Test Procedure	Expected Output	Test Result Analyzing
1	Click the administrator link	The new administrator page is displayed.	The new administrator page is displayed at the parent frame.
2	Fill in the new administrator page. Click the Add button.	The record is inserted permanently.	Record is inserted successfully.
3	Positioning the cursor at the position of the record that just added. Click the Edit button. Edit certain column of the record. Click the Update button.	The record is edited permanently.	Record is edited successfully.
4	Delete the record just added by positioning the cursor at the record position. Click the Delete button.	The record is deleted permanently.	Record is deleted successfully. Objective of integrating all the functions of new administrator module is achieved.

Table 6.2 Partial Test Cases for New Administrator Module

6.3.3 Sub-System Testing

Sub-system testing involves testing a collection of modules that are integrated into sub-systems. The most common problem is sub-system interface mismatches. Therefore, this test should concentrate on the detection of interface errors (Pressman, 2001).

6.3.3.1 Sub-System Test Case Example

For the system, all modules were tested together by using sample data to ensure all the modules can be integrated properly. Table 6.3 shows partial of the test case for sub-system of the application. It shows the some of integration testing between search module and adding new document module.

No	Test Procedure	Expected Output	Test Result Analyzing
1	Select the act table in the document administration module. Then, click Add button.	The new document page for act table should be displayed.	The new document page for act table is displayed in the parent frame.
2	Fill in the new act document page. Click the Add button.	The record is inserted permanently.	Record is inserted successfully.
3	Click the search link	The search page displayed.	The search page is displayed in the parent frame.
4	Type in the keyword that has just entered in the new act document page. Click the Search button.	The search result returned and displayed.	The search result is returned and displayed in the parent frame.
5	Click on the link on the displayed results.	The link should display the related document.	The related document is displayed in the parent frame.

Table 6.3 Partial Test Cases for Sub-System of NEPIS System

6.3.4 System Testing

The sub-systems are integrated to obtain the entire system. System testing is concerned with finding errors, which result from unanticipated interactions between sub-systems and system components. It is also concerned with ensuring that the system meets its functional and non-functional requirements (Pressman, 2001). Once the entire system is validated, it must also be combined with other system elements such as hardware, end-user and databases. System testing verifies that elements are functioning properly, and the overall system performance and objectives are achieved, which in this case, NEPIS must achieve reliability, robustness, accuracy, flexibility and modularity.

6.3.4.1 Stress Test

Stress test evaluates the system when stressed to its limits over a short period of time. Activating ten searches simultaneously in the lab was carried out to conduct the stress test.

The test result showed that the system is able to activate ten searches simultaneously without any problem.

6.3.4.2 Performance Test

This test tested the run-time performance of the system. Respond time of the returned search results was checked to verify the performance of the system.

The test result showed that the response time for the system is fast because it is run under a Local Area Network in the lab.

6.3.4.3 Usability Test

Usability Test was carried out in system testing. This test is an attempt to find human-factor, or usability, problems. The following is a list illustrating the kinds of consideration (Mehrez, Howard, Howard, Howard 1993) that have been tested and the test result analyzing with the help from the five non-computer base testers and five computer base tester.

No	Consideration	Test Result Analyzing
1	Has each user interface been tailored to the intelligence, education background and environmental pressures of the end user?	100% of the non-computer base testers do not facing any problem in using the system. Could be concluded that the system is not only tailored to the intelligence end user.
2	Are the outputs of the program meaningful, nonabusive, devoid of "computer gibberish" and son on?	100% of the testers agreed that all the outputs of the program are meaningful and proper labeled.
3	Does the total set of user interfaces exhibit considerable "conceptual integrity, an underlying consistency and uniformity of syntax, conventions, semantics, format, styles, and	88% of the testers think the user interface of the system are consistent while 12% of the testers think the interface less attractive.

	abbreviations?	Could be concluded that the testers are satisfied with the consistency of the user interface except for the interface more professional but less attractive.
4	Is the program easy to use? For instance, does entering a command into a time-sharing system require repeated shifts between upper- and lower-case characters?	100% of the testers agreed that the system is easy to use. Could be concluded that the system is easy to use.

Table 6.4 Usability testing

6.4 Summary

This chapter starts with introducing testing to the reader. Testing is done after coding and implementation process. The purpose of testing the system is to find out faults that are undetected during the coding and implementation process. Besides that, testing helps to verify functionality each module according to the system design. Different types of testing were carried to test the system so that it is reliable up to certain standards.

CHAPTER 7: System Evaluation and Conclusion

7.1 Introduction

When the system is fully tested for any errors, it is the time for system evaluation. The evaluation process will be able to identifying the system strength, system limitations, and future enhancements. They are many evaluation techniques that use to evaluate the final system. In the following section will explain in detail about the system strength and its limitation.

7.2 Problem Encounter and Solution

From the initial development phase until the end of development phase, many problems were faced. Among the encounter problems, some can be solved by using certain solution while some remain unsolved or could not be solved due to a few factors such as hardware limitation, lack of recourses. The following are some of the problems that arise during the development process.

7.2.1 Setting Up and Configuration

Setting up the server is a critical process for the operation and development of the application. It consumes a lot of time in setting up the server in the project initial state due to lack of experience. Furthermore, the repeated failure of the server require re-installation and re-configuration of the server, this consumes time and effort.

In the project initial state, the application's database is in Microsoft Access 2000. So, after the project initial state the database has to been exported to Microsoft SQL Server 7.0. Due the fact that Microsoft SQL Server 7.0 offers a lot more data type than Microsoft Access 2000, therefore after database exportation some of the data structure of the database changed and it must be design again to fit the original design.

The installation of Microsoft Windows 2000 Server is troublesome because restarting the server is a must wherever there is new software installed or the network setting is re-configured.

7.2.2 Requirements Changes

It is very difficult to develop and implement the system when the requirement changes very frequently. Sometimes it is easy to change the requirement, however, the coding need to be changed is a lot in order to follow the new requirement. In order to meet the requirements changes of the system, several discussion were carried among the writer's coursemates to analyze the changes for the system so that coding can be done accordingly to the changes.

7.2.3 Lack of Resources

In order to develop the application smoothly, the machine used to develop the system should at least have 128MB of memory (mention in Chapter 3). But, the writer was unable apply additional memory modules from the faculty because there was not enough memory module to distribute among students. So, the writer has to develop certain module at home and test run it in the faculty's lab.

7.2.4 Virus Attack

During the development of the system, the machine used to develop the system in the faculty's lab performs abnormally due to virus attack. The writer felt lucky that the anti virus program was installed on the server so the system was safe from virus attack. Even with the anti virus program installed on the development server, the writer backups the system's files everyday in case of disaster like hardware failure.

7.3 Evaluation by End Users

Due to the time constrain a proper or formal end user assessment cannot be conducted. Therefore, an informal approach was taken to let the end user to evaluate the system. The system was reviewed among the writer coursemates to obtain feedback regarding the system.

The writer examines each of the feedback given by his coursemates. By examine each of the feedback the writer manages to sort it out and combine the feedback to better enhance the system. Among the feedback were design a better user interface, enhance functionality of the system and so on.

Furthermore, the system was presented to the writer's project supervisor for reviews. In the review, the writer's project supervisor found some errors in the system and requested the error to be checked and debugged.

7.4 System Strengths

7.4.1 Web Enabled

The system is developed base on the web technology. It is using the client server approach that allows processing load to be shared between the client and the server, thus reducing the burden on the server and allow it to provide better service.

7.4.2 Graphical user interface (GUI)

The system is developed on the principal that it is easy to use. By using Microsoft Visual InterDev 6.0 and Microsoft Front Page 2000, the application is able to provide a fully interactive and user-friendly feature for the user.

7.4.3 Simplicity of User Interface

The screen design maintains its consistency throughout the system. Thus, users face less difficulty in seeking for a particular option that they require.

7.4.4 Authorization and authentication

Every administrator has a username and password. The application only allows authorized administrators to access the system. Furthermore, it has the capability of preventing unauthorized users from accessing the administrator page. An invalid login message will be prompted if a user tries to use the system without logging in or logging in wrongly. It ensures the administrator login before entering the system.

7.4.5 Scalability

Hardware and applications could be easily added to the existing system without influence the existing applications. This is because the system is not hardware dependency.

7.4.6 System Transparency

System transparency refers to the condition where the users do not need to know where the database resides, the system structure, the database management system, (DBMS) or anything related to the system built.

7.5 System Constraints

The system has some limitation due to time constraint and some others factor like programming skill level.

7.5.1 Browser Limitation

The system only supports Internet Explorer 5.0 and above, this is because most of the script is written in VB Script, which is not supported by other browser like Netscape Navigator.

7.5.2 Insufficient Documents

Since the main purpose of the system is to retrieve documents related to the National Education Policy, the database should have sufficient data related to the policy. But, the data input process require indexing keywords which is time consuming, therefore the database is loaded will enough data from the system to start functioning.

7.5.3 Insufficient Help

Help is only provided in the Search document module but it can be added in each of the modules in the system to guide the users just in case the users having trouble navigating through the system.

7.5.4 Unable to Edit Documents

The system is unable to provide the administrator with a module that can add or modify documents in the system. This is because Internet Explorer does allow opening of word processing software using programming codes. The fact was read found an article published in the Microsoft MSDN Library web site (http://support.microsoft.com/support/kb/articles/Q239/6/36.ASP).

7.6 Future Enhancement

The system limitations should be improved and corrected to enhance the functionality of the system in the future. These are some suggestions to add more values to the current version of NEPIS.

7.6.1 English Query Search

The search module can only supports keywords search to locate the intended documents according to the user search requirements. If the search engine behind the search module can understand natural language, this will prove useful to the users in finding the documents. Thus, enhance the usability of the system.

7.6.2 Discussion Board on Education Policy

Since the system itself is developed base on education policy, a discussion board on education policy can be posted in the system to share views and opinions among the users. By having the discussion board, information regarding the education policy can be spread among the users thus enhance information exchange.

7.6.3 Chat Room

A chat room can be put into the system for the users to discuss about the education policy. By having the chat room, the users can share their views related to education policy with online users. So, it will enhance communication among the users of the system. The researchers can use the chat room to discuss about education policy without having to meet in person thus saving cost of traveling and time.

7.7 Knowledge Gain

Knowledge gained throughout the development of National Education Policy Information System is undoubtedly valuable. The knowledge gained will sure prove useful in the future; following are some of the knowledge gain by the writer.

7.7.1 Setting Up Different Type of Server

During the development process of the system, the writer has the opportunities to set up the Window 2000 Server alone. Besides that, the write has a change to install and configure Microsoft SQL Server 7.0 in the client-server network environment. Since, the system is a web application, the writer also learn how to setup a web server using the Internet Information Server 5.0 (IIS 5.0). During the setup and installation process, some problems occur and the writer solves these problems by discussing them with his coursemates.

7.7.2 Learn Addition Software Tools

After finish developing the system, the writer has learned more programming language like Java Script, VB Script and Active Server Page ASP. The writer even gains some knowledge in design web page using web page publishing software like Microsoft Front Page 2000.

7.7.3 Improve Project and Time Management

The writer has learned how to manage a project so that it can meet it deadline without sacrificing the application functionality and quality.

7.8 Review of Goal

At the final stage of the project, there were certain expectations on what would be achieved. The following are the expectation that achieved.

7.8.1 Expectation Achieved

In overall, the system has fulfilled the expectation stated by the project. The basic foundation of the system is designed and implemented. The system is able to provide the function needed. It is eligible for future growth and implementation. The National Education Policy Information System meet the criteria like reliability, user friendliness, open system and wide accessible.

7.8.2 Objectives Achieved

The project has successfully created a system that uses a search engine to locate the documents related to the National Education Policy. Furthermore, the system itself can ease the administration of the documents related to the education policy. Therefore, it can be conclude that the system was able to achieve the intended objective.

7.9 Summary

The topic of system evaluation begins with problems encountered by the writer and solution to the problems. After that, the end user did some informal system evaluation and the comments given by them was useful in further enhance the system. Later in this chapter, the system strengths and limitations were touched. By reviewing the system again, the writer found out that some future enhancement could be made to the system to increase its functionality. Then, the writer discuss about the knowledge he has gain from developing the project. Finally, this chapter is ended with a review on goals and conclusion on the project.

7.10 Overall Conclusion

National Education Policy Information System has been completed successfully, with some strengths as well as limitations as mentioned. The system has achieved and fulfilled the objectives and requirements, as stated in the proposal and system analysis.

However, there are still rooms for improvement in the National Education Policy Information System. The enhancement of the system can be make in the future to meet the changing needs of the users.

Finally, this project has achieved its objective in giving the undergraduates an opportunity to undergo different challenges in different phases of the system development, that include research, system planning, system analysis, system design, system implementation, and system testing.

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